PHYSICS ABSTRACTS

SECTION A

of

SCIENCE ABSTRACTS

SECTION A, PHYSICS

SECTION B, ELECTRICAL ENGINEERING

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PRINCIPAL CONTENTS

August 1947

		PAGE
51	**MATHEMATICS**	193
52	**ASTRONOMY. ASTROPHYSICS. GEODESY**	193
53	**PHYSICS**	194
530.1	**Fundamentals**	194
530.14	Theory of particles	194
530.145	Quantum theory	195
531	**General mechanics. Mechanics of solids**	195
531.7	**Mechanical measurements**	196
532	**Mechanics of liquids**	196
532.6	**Capillarity**	197
532.7	**Kinetic theory of liquids**	197
533	**Mechanics of gases**	197
533.7	**Kinetic theory of gases**	198
534	**Vibrations. Acoustics**	198
534.2	Propagation	198
534.232	Acoustic radiators	199
534.321.9	Ultrasonics	200
534.84	Architectural acoustics	200
535	**Optics. Radiation. Spectra**	200
535.33/.34	Spectra	200
535.34	Absorption	201
535.37	Luminescence	202
535.375.5	Raman effect	202
535.4	Interference. Diffraction	203
535.6	Colour	203
535.8	Optical instruments	203
536	**Heat**	204
536.48	Low temperature phenomena	205
536.6	Calorimetry	205
536.7	**Thermodynamics**	205
537	**Electricity**	205
537.3	**Electric currents**	205
537.5	**Electric discharges and radiations**	206
537.531	X-rays	207
537.533	Cathode rays	207
537.534	Positive rays	207
537.591	**Cosmic rays**	208
538	**Magnetism**	209
538.3/.5	**Electromagnetism. Electrodynamics**	209
538.6	**Magnetic effects**	209
539	**Atomic and molecular structure**	209
539.152.1	Nucleus	210
539.155.2	Isotopes	211
539.16/.18	**Radioactivity. Nuclear disintegration. Nuclear particles**	211
539.17	Artificial disintegration	213
539.18	Neutrons	213
539.2	**Structure of solids**	215
539.3/.8	**Elasticity. Strength. Rheology**	215
541	**PHYSICAL CHEMISTRY**	217
541.121/.123	**Phase equilibrium**	217
541.124/.128	**Reaction kinetics**	217
541.13	**Electrochemistry**	218
541.183	**Adsorption**	218
541.4/.6	**Chemical structure**	218
542.9	**Chemical processes**	219
543/545	**Chemical analysis**	219
548	**CRYSTALLOGRAPHY**	220
549	**Mineralogy**	222
55	**GEOPHYSICS**	222
551.5	**Meteorology**	222
57/59	**BIOLOGY**	223
61	**Medical science. Human physiology**	223
666	**Glass. Ceramics**	224
669	**Metallurgy**	224
77	**PHOTOGRAPHY**	224

The headings printed in bold type will be found in the text. The others may be located by their U.D.C. number.

RELATED SUBJECTS CONTAINED IN SECTION B (ELECTRICAL ENGINEERING ABSTRACTS)

Mechanical testing
Non-destructive testing
Industrial radiography
Corrosion
Electrical and magnetic measurements and instruments
Electronic relays and counters
Automatic control mechanisms
Applied electrochemistry
Photocells
Thermionic tubes
Cathode-ray tubes
X-ray tubes
Induction accelerators
Cyclotrons
Amplifiers
Radio-wave propagation
Mechanical engineering
Heat engines
Illumination
Metallurgy

NOTE ON THE ARRANGEMENT OF ABSTRACTS

The Abstracts are classified by subject according to the Universal Decimal Classification, and arranged in order of their U.D.C. numbers, which are printed at the head of the Abstract on the left. Abstracts on any particular subject can be located by first consulting the abridged tables of the U.D.C. published with the January number, or the Annual Alphabetical Subject Index, and then referring to the appropriate U.D.C. number in the text. The main headings are listed above.

An Abstract of interest under more than one head has additional U.D.C. numbers, linked by the colon sign, ":" e.g. "536.21 : 548.0 Conduction of heat in crystals." The Abstract is printed once only, under the main number, e.g. in the section "HEAT 536," but Cross-references are inserted under the other numbers, e.g. "548.0 : 536.21 *see Abstr.* 1234" in the section "CRYSTALLOGRAPHY 548." These Cross-references should be investigated, therefore, when a particular section is being searched, as they contain additional matter relevant to that section. A Cross-reference does *not* refer to the Abstract which appears immediately above it.

[*Continued on page 3 of cover*

MATHEMATICS 51

12.972 : 621.3.011 = 4 1996
Tensors and electricity. BOUTHILLON, L. *Ann. adioélectricité*, **1**, 345–58 (*Oct.*, 1946) *In French.*—Abstr. 1884 B (1947)].

17.512.4 : 538.566.5 : 621.392 1997
On some series of Bessel functions. INFELD, L., SMITH, G., AND CHIEN, W. Z. *J. Math. Phys.*, **26**, 22–8 (*April*, 1947).—The series summed are of the form $(-)^m Y_0(mx)$, and they arise in the study of radiation om a cylindrical aerial in a rectangular waveguide.
L. S. G.

17.934 1998
A note on Van der Pol's equation. DE BRUIJN, N. G. *hilips Res. Rep.*, **1**, 401–6 (*Dec.*, 1946).—Shohat's eatment of the case $\varepsilon \gg 1$ [Abstr. 60 (1945)] is criticized.
A.

17.944 : 530.145.6 = 4 1999
Integration of equations: the Liouville case. FAURE, R. *.R. Acad. Sci., Paris*, **222**, 1032–3 (*April* 29, 1946) *In rench.*—It is shown that in classical mechanics the quations describing a system may, in the Liouville case, e solved by separating the variables; but this is not ossible in wave mechanics, and this is shown by an xamination of Schrödinger's equation. L. S. G.

17.948.3 2000
A remark on the variational method. DAVISON, B. *Phys. ev.*, **71**, 694–7 (*May* 15, 1947).—A theorem connected ith the method used by Marshak [Abstr. 2254 (1947)].

17.948.3 : 539.185 *see Abstr.* 2254

18.5 : 531.717 *see Abstr.* 2039

518.5 : 621.3.012.8 : 531.3 *see Abstr.* 2038

519.211 2001
The foundation of the theory of probability. I. SCHRÖDINGER, E. *Proc. R. Irish Acad.*, **51 A** (*No.* 5) 51–66 (1947).—It is pointed out that there are serious objections to adopting the frequency definition of probability as a basis for the theory, and in the present paper this is avoided. The number of axiomatic statements is also reduced to a minimum, and only the product rule retains this rank. The summation rule for probabilities is introduced, and the problem of determining probability from statistical frequency is discussed. Two examples are given.
L. S. G.

519.24 : 539.16.08 2002
Note on the statistical analysis of counter data. HOLE, N. *Ark. Mat. Astr. Fys.*, **34 B** (*Paper* 12) 8 *pp.* (1947).—Practically convenient simplifications of the application of the method of maximum likelihood to the estimation of decay constants are developed. Variability of estimates is not considered.
N. L. J.

519.24 : 621.318.57 = 3 2003
Notes on the mathematical theory of recording counters. JOST, R. *Helv. Phys. Acta*, **20** (*No.* 2) 173–82 (1947) *In German.*—This paper investigates the accuracy of records of series of events occurring in a simple discontinuous stationary random process. The probability of an event being recorded is assumed to depend on the time elapsed since either (*a*) the last recorded event, or (*b*) the last event. Each case is treated separately. The combination of two counters of either type is also considered.
N. L. J.

ASTRONOMY . ASTROPHYSICS . GEODESY 52

521.03 : 621.396.96 2004
Radar echoes from the moon. MOFENSON, J. *Electronics*, **19**, 92–8 (*April*, 1946).

522.24 : 523.821 = 4 2005
On the transparency of a lens for stars and the formula or the limit of magnitude. ROY, L. *C.R. Acad. Sci., aris*, **224**, 1088–91 (*April* 14, 1947) *In French.*

523.11 : 531.51 : 538.3 : 530.12 = 3 *see Abstr.* 2017

523.165 : 523.72 *see Abstr.* 2007

523.165 : 535.234 : 537.591 = 3 *see Abstr.* 2174

523.32 : 551.521.2 : 551.524.7 *see Abstr.* 2347

523.53 : 551.510.535 : 621.396.9 2006
The radio detection of meteor trails and allied phenomena. APPLETON, E., AND NAISMITH, R. *Proc. Phys. Soc., Lond.*, **59**, 461–72 (*May*, 1947).—The results of a series of radio sounding observations on (*a*) transient bursts of atmospheric ionization, and (*b*) abnormal or sporadic *E*-layer ionization, are described and discussed. Observations during the Giacobinid meteor shower of October 10, 1946, confirm that the ionization bursts which can be observed at all hours of the day are due to sporadic meteors. A statistical study of abnormal or sporadic *E*-layer ionization gives strong support to the view that, in temperate latitudes, this phenomenon is also largely ascribable to the same cause. Whistling meteors are also discussed.
A.

523.72 : 523.165 2007
Emission of radio-waves by the galaxy and the sun. SHKLOVSKY, J. S. *Nature, Lond.*, **159**, 752–3 (*May* 31, 1947).—The results of modifying Henyey and Keenan's theory [*Astrophys. J.*, **91**, 625 (*June*, 1940)] to allow for absorption of radio-waves by electron damping in the galaxy are given, and the optical depth of the galaxy in various directions worked out from Reber's measurements. The results conflict somewhat with Strömgren's values for the extent of the zones of ionized hydrogen [Abstr. 2430 (1939)]. The optical depth of the solar atmosphere for different frequencies has also been calculated. Reber's measurements in the metre region indicate a temp. of the outer corona of only 3 500°.

523.755 2008
Results from observations of the total solar eclipse of 1945 July 9. I. The polarization of the corona. ÖHMAN, Y. *Stockholms Obs. Ann.*, **15** (*No.* 2) 58 *pp.* (1947).—Four independent photographic methods were used to study the polarized corona, in five colours, out to $2{\cdot}86\,R_\odot$ from solar limb; these, after correction for instrumental and atmospheric scatter, yield concordant measures. Results indicate: (*a*) no change in colour, with polarization independent of wavelength out to $1{\cdot}5\,R_\odot$; (*b*) polarization at poles much less than at equator, the latter a maximum near $0{\cdot}6\,R_\odot$, decreasing considerably beyond $1{\cdot}0\,R_\odot$. These confirm Vashakidse's observations although (*b*) does not wholly support existing theory.
D. R. B.

523.821 : 522.24 *see Abstr.* 2005

523.852 = 4 2009
The recession of nebulae and their space distribution. DRUMAUX, P. *Ann. Soc. Sci. Brux.* (*Sér.* 1) **60**, 212–17 (*Dec.* 12, 1946) *In French.*—Examines the connection

between the linear law of recession of the extra-galactic nebulae and their space distribution. The author deduces that this depends on the previous history of the nebular system to which the nebulae of the explored region belong. V. C. A. F.

523.873 : 535.338.4 2010

A spectrophotometric investigation of molecular bands of CN and CH in stars of late spectral types. SETTERBERG, T. *Stockholms Obs. Ann.*, **15** (*No.* 1) 68 *pp.* (1947).—Intensities of prominent band heads and of the integrated effect of band lines at chosen wavelengths are measured in 71 stars of types F8–M2. The results (expressed as magnitude differences from the neighbouring background) are analysed to show correlations with spectral type and absolute magnitude, and compared with theoretical estimates of abundance. D. L. E.

526.72 = 5 2011

Instrument for photographic recording of pendulum observations of gravity. CHELLA, M., AND SOLAINI, L. *Ric. Sci.*, **13**, 683–97 (*Nov.*, 1942) *In Italian.*—See Abstr. 3915 (1933). A description of the time-signal apparatus incorporating a buzzer and a 120 c/s tuning fork for marking, together with a projection arrangement for the recording, and of some observations taken at Pisa and at Milan, which showed a mean error of $\pm 4\times10^{-4}$ sec. J. A. W.

PHYSICS 53

53.081.3 : 535.241 *see Abstr.* 2087

53.088.3 = 393 2012

Limit of sensitivity. VAN SOEST, J. L., AND BORDEWIJK, J. L. *Tijdschr. Ned. Radiogenoot.*, **12**, 113–23 (*May*, 1947) *In Dutch.*—A general discussion of sensitivity of measurement and restrictions on the accuracy of measuring instruments and scale readings. J. A. W.

FUNDAMENTALS 530.1

530.1 2013

What experiments are needed in fundamental physics? PEIERLS, R. E. *Proc. Phys. Soc., Lond.*, **59**, 412–17 (*May*, 1947).—A brief outline is given of the chief outstanding difficulties of fundamental theory concerning the nature, origin and properties of nuclear forces, the properties of mesons, their inter-relation with other particles and their connection with nuclear forces, the lifetime of the meson and its relation to ordinary beta-processes, and with the classification of atomic energy levels. A discussion is given of some experiments which might become possible with modern technique and which are likely to help provide the answer. A.

530.12 2014

Radiation damping in the general theory of relativity. HU, N. *Proc. R. Irish Acad.*, **51 A** (*No.* 7) 87–111 (1947).—A theory of gravitation and motion is presented which is a modification of the recent theory of Einstein, Infeld and Hoffmann [*Ann. Math.*, **39**, 65 (1938); **41**, 455 (1940)]. In the new method the mass particles are treated as extended sources (instead of singularities) of the field; the energy-momentum tensor is found and the equations of motion result from the law of conservation of energy-momentum. Application is made to the evaluation of the radiation damping force. L. S. G.

530.12 2015

Some new results regarding spherically symmetrical fields in relativity. NARLIKAR, V. V. *Curr. Sci.*, **16**, 113–14 (*April*, 1947).—Reports some results for non-static line elements, including an expression for the energy within a spherical region in terms of conditions over the boundary. R. A. N.

530.12 : 531.51 : 538.3 = 4 2016

A synthetic law of gravitation and electromagnetism. HÉLY, J. *Ann. Phys., Paris* (*Sér.* 11) **19**, 208–14 (*April–June*, 1944) *In French.*—It is shown that the restricted theory of relativity, in a Euclidean space-time, is sufficient to explain: (*a*) the progression of the perihelion of Mercury, (*b*) the deviation of a light ray passing near the sun, (*c*) the displacement towards the red of the spectrum of dense stars (white dwarfs) and (*d*) the constancy of the ratio of inertia to mass for all atoms. The novel idea introduced is that of "gravitational phase," which consists of two parts, one being a function of the gravitational force and the other being $\pi/6$ for matter and $\pi/2$ for light. L. S. G.

530.12 : 531.51 : 538.3 : 523.11 = 3 2017

Field equations with a variable "constant" of gravitation. JORDAN, P., AND MÜLLER, C. *Z. Naturforsch.*, **2a**, 1–2 (*Jan.*, 1947) *In German.*—The constant of gravitation, κ, is treated as a 15th field variable in 5-dimensional projective Relativity, allowing for the possible variation of κ in cosmological problems. For pure gravitational fields, the 15 equations $R_{\mu\nu}=0$ reduce to the ordinary equations for empty space if κ = constant. The existence of an electromagnetic field implies a variable κ, but the Einstein–Maxwell equations for combined gravitational and electromagnetic fields in the absence of matter can be obtained as a first approximation. R. A. N.

530.14 = 4 2018

Nuclear, gravitational and electromagnetic forces. GIÃO, A. *Portugal. Math.*, **5** (*No.* 3) 145–92 (1946) *In French.*—The aim of this work is to show that the cosmological theory developed earlier [Abstr. 2737 (1946)] allows the three types of forces to be united into a single principle. Wave functions for elementary particles and the energy-momentum tensor are set up and their properties are discussed. The equations of motion are deduced from the principle of conservation of the energy-momentum tensor, and this involves a study of the equations of geodesics in the presence of the three types of forces mentioned. The meson field is discussed and the equations of the field are developed. L. S. G.

530.14 = 4 2019

Some properties of cosmological wave functions for elementary particles. GIÃO, A. *Gaz. Mat.*, 7, 4–5 (*Nov.*, 1946) *In French.*—Previous work [Abstr. 2018 (1947)] is continued and the use of the wave functions in the treatment of radiation is discussed. The principle physical properties that may be deduced from the various wave functions are tabulated. L. S. G.

530.14 = 4 2020

Non-linear wave equations in the quantum theory of the electron. KWAL, B. *C.R. Acad. Sci., Paris*, **224**, 1099–100 (*April* 14, 1947). *In French.*

530.14 = 4 2021

Non-linear theory of photon and meson. A modification of the theory of Yukawa. KWAL, B. *C.R. Acad. Sci., Paris*, **224**, 1207–8 (*April* 21, 1947) *In French.*

530.14 : 538.3 2022

Equivalence of the Riesz method and the λ-limiting process for the classical electromagnetic field of a point source. MA, S. T. *Phys. Rev.*, **71**, 787–92 (*June* 1,

47).—It is shown generally that the Riesz method of alytic continuation and the λ-limiting process give, in neral, the same results for both the classical electro-agnetic potential of a point source and all its derivatives th respect to the co-ordinates of the field point. A.

30.14 : 539.152.1 2023

Electromagnetic field of multipoles. BERESTETZKY, V. *Phys., USSR*, **11** (*No.* 1) 85–90 (1947).—A simple rivation is given. A.

30.145 = 4 2024

A new method for studying the potential barrier problem theoretical physics. DAUDEL, R. *C.R. Acad. Sci., ris*, **222**, 1337–8 (*June* 3, 1946) *In French.*—A purely antum method is given and an expression is obtained r the height of the potential barrier. L. S. G.

30.145 = 4 2025

Role of electromagnetic field in the correspondence tween classical and wave mechanics. FAURE, R. *C.R. ad. Sci., Paris*, **224**, 1209–10 (*April* 21, 1947) *In French.*

30.145 = 4 2026

On an interpretation of de Broglie's photon equations. URARD, R. *C.R. Acad. Sci., Paris*, **222**, 1030–2 pril 29, 1946) *In French.*—A previous relativistic theory a system of particles [Abstr. 1963 (1937)] is applied to e photon, and equations of the same form as those of Broglie are obtained. The photon may be considered a system of two Dirac particles with no relative motion, nd the equations describe the motion of the c.g. and the lativistic invariance of the condition that the motion out the c.g. be zero. The interaction operator of the o particles is zero. L. S. G.

30.145 = 4 2027

Remarks on the physical interpretation of de Broglie's quations for the photon. MURARD, R. *C.R. Acad. Sci., aris*, **222**, 1075–6 (*May* 6, 1946) *In French.*—A continuation of previous work [Abstr. 2026 (1947)]. Some roperties of the wave functions of the two particles are iscussed. L. S. G.

30.145 : 536.48 : 532.7 *see Abstr.* 2051

30.145 : 537.122 2028

On the electrostatic self-energy of the electron in the ole theory. NILSSON, S. B. *K. Fysiogr. Sällsk. Lund, örh.*, **16** (*No.* 24) 9 *pp.* (1946).—The calculations of ustafson [Abstr. 2031 (1946)], using Riesz's method of nalytic continuation for solving the wave equation, are epeated on the assumption of the hole theory instead f the one-electron theory, where well-known divergences were eliminated. The divergence of the electrostatic elf-energy is only logarithmic in the hole theory [Abstr. 149 (1939)], and the result is that it is not possible, in this heory, to make the (non-retarded) electrostatic energy f the electron finite by means of analytic continuation. L. S. G.

30.145.6 2029

The foundations and philosophical implications of wave uechanics. SHU, S. *Canad. J. Res. A*, **25**, 96–117 *March*, 1947).—This paper attempts to show: (*a*) The ature of the basic assumptions made either explicitly r implicitly by de Broglie in arriving at the fundamental ormula, $\lambda = h/p$, of wave mechanics, and that at least ome of these assumptions are open to criticism. (*b*) That t is a little too hasty to regard as demonstrated the non-ocalization of photons or electrons in motion and the ack of determinism with respect to them. (*c*) That the resuppositions which lead to the "relations of in-ertitude" involve highly arbitrary elements, and these "relations" are read into or arbitrarily imposed upon the hysical world rather than really found to be in it. (*d*) That it is an unwarranted claim that the new mechanics can contribute to the solution of the philosophical problem of free will. (*e*) That it is possible to render the foundations of wave mechanics logically independent of the theory of relativity. A.

530.145.6 2030

On relativistic wave equations. HARISH-CHANDRA. *Phys. Rev.*, **71**, 793–805 (*June* 1, 1947).—The problem of the relativistic invariance of a 1st-order wave equation with matrix coefficients β_k is examined. It is found that it is intimately connected with the structure of the enveloping algebra of the β-matrices. In particular the centre of this algebra can contain only elements of a very restricted type. This fact provides a powerful means for the investigation of the abstract β-algebra, as is illustrated in the general s-dimensional case of the Dirac and the Duffin–Kemmer matrices. Relativistic invariance imposes severe restrictions on the spurs of the β-matrices and their multiple products. Conversely, these restrictions ensure relativistic invariance. The theory is applied to the case of particles of higher spin. A.

530.145.6 : 517.944 = 4 *see Abstr.* 1999

530.145.63 2031

Unboundedness of quantum-mechanical matrices. WINTNER, A. *Phys. Rev.*, **71**, 738–9 (*May* 15, 1947).—It is shown that P and Q cannot be bounded if they are Hermitian and if the Heisenberg relation, $QP - PQ = \frac{1}{2}iE$, holds, where E is the unit matrix. W. E. D.

530.145.63 2032

Interpretation of complex roots of the S-matrix. HEITLER, W., AND HU, N. *Nature, Lond.*, **159**, 776–7 (*June* 7, 1947).

530.162 = 69 2033

The uncertainty relations of Heisenberg. DAVID, F. S. *Gaz. Mat.*, **7**, 6–7 (*Feb.*, 1946) *In Portuguese.*—The usual relation, $\Delta p \Delta q \sim h$, is extended into $\Delta p \Delta q \geqslant \alpha h$ where α is a constant of the order of unity. L. S. G.

GENERAL MECHANICS . MECHANICS OF SOLIDS 531

531.258 2034

On a problem of elastico-plastic bending of plates. SOKOLOVSKY, W. W. *C.R. Acad. Sci., URSS*, **52** (*No.* 1) 13–16 (1946).—The plate considered is circular and subject to axially symmetric pressure. Formulae are found for the stress components in the elastic and in the plastic layer, and for the stress couples. L. S. G.

531.258 2035

Large deflections of circular and square plates. CONWAY, H. D. *Phil. Mag.*, **37**, 756–67 (*Nov.*, 1946).—Approx. formulae for the deflections and stresses are obtained for uniformly loaded plates, supported at the edges. L. S. G.

531.258 2036

The large deflections of rectangular membranes and plates. CONWAY, H. D. *Phil. Mag.*, **37**, 767–78 (*Nov.*, 1946).—Previous formulae [Abstr. 2035 (1947)] are extended to apply to rectangular membranes and plates with length/breadth ratios of 1 to 4. L. S. G.

531.259.1 : 539.374 2037

Plastic stresses in a semi-infinite cohesive mass due to a surcharge covering a strip of the surface of infinite length. BOULTON, N. S. *Phil. Mag.*, **37**, 733–46 (*Nov.*, 1946).—The mass possesses cohesion and internal friction, and it has a horizontal surface, a strip of which is loaded uniformly, so that the state of plastic stress is 2-dimensional. The problem is to find the bearing pressure on the strip. The general equations are solved approx. in terms of the first three terms of a series for the stress

function. The total pressure on the strip required to maintain plastic equilibrium is calculated. L. S. G.

531.3 : 518.5 : 621.3.012.8 2038

Analysis of problems in dynamics by electronic circuits. RAGAZZINI, J. R., RANDALL, R. H., AND RUSSELL, F. A. *Proc. Inst. Radio Engrs, N.Y. Wav. Electrons*, **35**, 444–51 (*May*, 1947).—Stabilized feed-back amplifiers of standard design are made to serve as integrator, differentiator or sign changer merely by change of external connections. Analogous circuits are thus built up to give the solution of complicated mechanical problems. Such electronic circuits enable individual parameters to be varied easily, and the use of grid bias gives a simple control of limiting conditions in agreement with the practical physical problem. The method is illustrated by an aerodynamical example. A. J. S.

531.51 : 538.3 : 523.11 : 530.12 = 3 *see Abstr.* 2017

531.51 : 538.3 : 530.12 = 4 *see Abstr.* 2016

MECHANICAL MEASUREMENTS 531.7

531.717.1 : 518.5 2039

An instrument for measuring particle diameters and constructing histograms from electron micrographs. HANSON, E. E., AND DANIEL, J. H. *J. Appl. Phys.*, **18**, 439–43 (*May*, 1947).—The computer consists of a scanning mechanism for setting manually two pairs of mutually perpendicular lines on the outline of the particle, and a coupled recording mechanism for dropping a steel ball into a compartment corresponding to a range of diameters containing the arithmetic average of the two measured diameters of the particles.

531.754.2 : 539.215.4 *see Abstr.* 2259

531.756 = 397 2040

Differential measurement of density of liquids. LAGERQVIST, P. A. *Tekn. Tidskr.*, **77**, 421–2 (*May* 10, 1947) *In Swedish.*—A thin-walled glass bulb with a hook for carrying small fine-adjustment weights is immersed in the liquid, which is placed under pressure. If the compressibility of the bulb > that of the liquid, it sinks with increase of pressure, otherwise it rises. Comparing two liquids, the difference in density is obtained from the pressure differences. The apparatus is described and illustrated and application to the determination of heavy-water content in electrolytic water is explained. J. A. W.

531.788.6 2041

An investigation on hot-wire vacuum gauges. VON UBISCH, H. *Ark. Mat. Astr. Fys.*, **34 A** (*Paper* 14) 33 *pp.* (1947).—Filaments of Mo, Ni, W and Pt, of various cross-sections (measured microscopically) and lengths, maintained at various temperatures in air, H_2 and CO_2, were investigated. Some filaments were in narrow glass capillaries or in spiral form. Identical filaments formed opposite arms of a Wheatstone bridge, of which the other two arms were precision resistors. With a manually operated balanced bridge, pressure changes of 10^{-5} mm Hg could be detected at low pressures, the useful range being extended to about 30 mm Hg pressure for thin filaments. With a direct-reading bridge with constant current supply, the sensitivity and calibration curve are influenced markedly by the galvanometer current. A theory of the distribution of temperature on a filament is developed. S. W.

MECHANICS OF LIQUIDS 532

532.12 : 534.321.9 : 534.22 = 3 *see Abstr.* 2069

532.123/.13 : 534.133 2042

Measurement of the viscosity and shear elasticity of liquids by means of a torsionally vibrating crystal. MASON, W. P. *Trans. Amer. Soc. Mech. Engrs*, **69**, 359–70 (*May* 1947).—Theory and experimental details are given. The elastic properties are determined from observations of the reactance and resistance loading of the crystal, resulting in a lowering of frequency and raising of resistance at resonance. The shearing stress can be varied by varying the voltage on the crystal. Results on light oils (viscosity 0·01–10 poises) check with previous determinations within a few %. A.

532.5 204

Fundamental equations of motion of compressible fluids through compressible media. SHCHELKACHEV, V. N. *C.R. Acad. Sci. URSS*, **52** (*No.* 2) 103–6 (1946).—The differential equation of continuity is developed and applied to the motion of water-oil-bearing layers, such as occur in oil wells. L. S. G.

532.5 204

Analysis of unidimensional motion of a compressible fluid in a compressible porous medium. SHCHELKACHEV, V. N. *C.R. Acad. Sci. URSS*, **52** (*No.* 3) 203–6 (1946).—The differential equation of a previous paper [Abstr. 204 (1947)] is solved in the special case of transient motion in one dimension; the solution is used to plot graphs showing the increase of the fall of pressure with time. L. S. G.

532.516 204

The hydrodynamic lubrication of finite sliders. BOEGLI, C. P. *J. Appl. Phys.*, **18**, 482–8 (*May*, 1947).—Two approximations are made in the solution of Reynolds lubrication equation for the case of a finite slider, and these lead to a series of equations that are easy and rapid to use. Examples of their use are presented. The method is of special value for wide sliders which are difficult or impossible to analyse by other methods. A.

532.528 204

Cavitation from solid surfaces in the absence of gas nuclei. PEASE, D. C., AND BLINKS, L. R. *J. Phys. Coll. Chem.*, **51**, 556–68 (*March*, 1947).—A distinction is made between "false" cavitation, when gas nuclei are present in a liquid, and "true" cavitation, when gas nuclei are absent. In the latter case, cavitation in a liquid in a glass vessel can only be produced by large forces, unless the glass surface is rendered hydrophobic. Treating the hydrophobic surface, to produce once again a hydrophilic surface, greatly increases the difficulty of producing cavitation. The conclusion drawn is that, in the absence of pre-existing nuclei, cavitation requires large forces except where liquid molecules are held to a solid surface by weak forces (van der Waals forces) which allow a "tear" to occur at the solid/liquid interface. J. I.

532.528 : 534.232 *see Abstr.* 2076

532.542.1 : 539.374 *see Abstr.* 2272

532.58 204

The rise of air bubbles in lubricating oils. ROBINSON, J. V. *J. Phys. Coll. Chem.*, **51**, 431–7 (*March*, 1947).—Rates of rise of small air bubbles in oils were measured and found to obey Stokes's law, except when the oil contained foam inhibitors or lubricating additives. In this case a gel structure is formed round the bubbles, and to account for the abnormally slow velocity a liquid shell, of max. thickness equal to the bubble diameter, must be assumed to move with the bubble. J. I.

532.59 204

Characteristic features of a liquid flow in an open channel. VEDERNIKOV, V. V. *C.R. Acad. Sci. URSS*, **5** (*No.* 3) 207–10 (1946).—The flow is classified according to the propagation of wave motion in the channel. A certain function, f, of the channel parameters is introduced, and if $f < 1$ the flow is tranquil or rapid, and

ositive or negative waves, when moving along the ream, decrease in height, become damped and the riginal steady motion is restored. If $f > 1$, waves ecome steeper and tend to move along without change f shape. These results are extended to the case where ie initial motion is not uniform. L. S. G.

CAPILLARITY 532.6

32.6 2049

The fundamental concepts concerning surface tension id capillarity. Brown, R. C. *Proc. Phys. Soc., Lond.*, 9, 429–48 (*May*, 1947).—On the basis of the usual idea f cohesion between molecules it can be shown that, in ontradiction to what is often contended, it is not necess- y to deny the reality of surface tension during the course f an explanation of the common phenomena which were, one time, regarded as providing evidence of its istence. It is possible, also, to gain a less abstract onception of the distinction between free and total rface energy than that provided by a purely thermo- ynamical discussion. The customary assumption that a system containing a solid/liquid interface the surface ergy of the solid plays an identical role with that of the quid is criticized, and the conception of surface energy s the work done during the rupture of a column of aterial is examined. Capillary elevation is regarded as consequence of negative surface tension in the liquid at ie solid/liquid interface, and the usual expression for the apillary rise is derived from this idea. A.

32.613.5 : 541.183.36 2050

The effect of pressure on surface tension. Rice, O. K. *Chem. Phys.*, **15**, 333–5 (*May*, 1947).—The thermo- ynamic formula for the change of surface tension with ressure is interpreted for a 1-component system, and for 2-component system consisting of an inert gas over a quid. In the latter case the effect can be attributed in art to absorption of gas at the surface of the liquid, and part to an intrinsic decrease in density of the liquid in ie neighbourhood of the surface. The equations are terpreted in terms of the Gibbs adsorption isotherm. he adsorption of gas at the liquid surface has been timated in several cases from data in the literature. A.

KINETIC THEORY OF LIQUIDS 532.7

32.7 : 530.145 : 536.48 2051

Quantum theory of liquids. Born, M., and Green, t. S.; Fürth, R. *Nature, Lond.*, **159**, 738–9 (*May* 31, 947).—A brief report is given of the results of a direct pplication of the laws of quantum mechanics to a dense ssembly of particles. The "density matrix" $\rho_N(X, X')$ of wo different configurations $X = (X_1, X_2 \ldots X_N)$ and $' = (X'_1, X'_2 \ldots X'_N)$ replaces the distribution function f co-ordinates and velocities used in classical theory, nd $\hbar\partial\rho/\partial t = W\rho - \rho W$, where W is the energy operator nd the products are matrix products. It is found that ie quantum laws governing the behaviour of matter in ulk are identical with the classical laws, but the tomistic interpretation of the quantities appearing in ie equations show great deviations from "classical" quid behaviour. Thus the temp. T_1 defined by the mean inetic energy, and which determines the flux of energy, not identical with the equilibrium temp. T, defined as ie integrating denominator of the entropy. There is a milar dichotomy between the hydrodynamic and the ermodynamic pressure. The applications to liquid le II are discussed. Fürth supplies a qualitative physical xplanation of superfluidity, on the basis of vanishing collision cross-section of atoms at low temps. where the de Broglie wavelength becomes large, in analogy with the Ramsauer effect.

532.7 : 536.222 *see Abstr.* 2131

532.7 : 536.48 2052

On the theory of superfluidity of helium II. Landau, L. *J. Phys., USSR*, **11** (*No.* 1) 91–2 (1947).—The author makes some modifications in the assumptions of his earlier theory to remove the discrepancy with the experimental value of "second sound" velocity [Abstr. 614 (1947)]. These lead to a form of energy spectrum of the excitations ("phonons" and "rotons") of He II in which the energy at first rises linearly with momentum, then decreases to a minimum at a certain value p_0 of the momentum. The values of the roton momenta thus lie mainly in the neighbourhood of p_0, and the roton mass μ is constant, approx. the mass of the He atom. The main conclusions of the theory are unchanged.

532.7 : [536.652 + 536.421] *see Abstr.* 2133

532.72 = 4 2053

On the equation of diffusion in liquids. Gand, C., and Calvet, E. *C.R. Acad. Sci., Paris*, **222**, 1295–7 (*May* 27, 1946) *In French.*—Experimental methods are described for finding the values of numerical constants appearing in the equation. Application is made to the diffusion of NaCl and hydroquinone in water. L. S. G.

532.73 : 536.753 2054

The entropy of solution of molecules of different size. Hildebrand, J. H. *J. Chem. Phys.*, **15**, 225–8 (*May*, 1947).—The entropy of mixing two liquids whose molecules differ in size is expressed in terms which avoid the assumption of a lattice as an artificial frame of reference, and which is not limited to linear polymers. With certain simplifying assumptions, the equation reduces to the form obtained in a lattice frame of reference. Various methods of obtaining experimental values for molecular volume are outlined. A.

532.74 : 535.343.32/.4 = 3 *see Abstr.* 2100

532.782 : 536.653 = 3 *see Abstr.* 2141–2

532.782 : 541.123.2 = 3 *see Abstr.* 2284

532.782 : 548.73 *see Abstr.* 2322

MECHANICS OF GASES 533

533.15 : 536.423.1 2055

The escape of molecules from a plane surface into still air. Brookfield, K. J., Fitzpatrick, H. D. N., Jackson, J. F., Matthews, J. B., and Moelwyn-Hughes, E. A. *Proc. Roy. Soc. A*, **190**, 59–67 (*June* 17, 1947).—The process by which a liquid evaporates from a free surface, diffuses through a layer of air and is finally removed by an absorber is discussed theoretically. Experiments were carried out with furfural, methyl salicylate and water, and the diffusion constants through air are deduced. H. L.

533.16 = 4 2056

Experimental investigations on the viscosity of gases at high temperatures. Vasilesco, V. *Ann. Phys., Paris* (*Sér.* 11) **20**, 138–76 (*March–April*); 292–333 (*May–June*, 1945) *In French.*—Precision measurements are described on the viscosity of air, N_2, A and CO_2 between 0°C and 1 600°C, in terms of the viscosity of air at 0°C, by the determination of the pressure drop along a capillary through which the gas flows at a constant flow rate. The accuracy of the viscosity ratio is 1/700 to 1/1000. The temperature is measured with an accuracy of 1°C up to 530°C and of 1·5° near 1 500°C. Two different methods for heating and for measuring the temperature are used; the results

are in good agreement. The author gives the results in terms of the Sutherland formula in which he replaces the constant C by a variable slowly changing with the temperature. The various corrections and sources of error are discussed and the whole problem of viscosity measurement is reviewed in detail. White's empircal formula on the flow through coiled tubes is confirmed by experiments on air, N_2, A and CO_2 at 0°C. H. L.

533.17.08 2057

A sensitive recording calorimetric mass flowmeter. BROWN, A. F., AND KRONBERGER, H. *J. Sci. Instrum.*, **24**, 151–4 (*June*, 1947).—The temperature distribution along a tube heated at its mid point is disturbed by the passage of gas, and electrical bridge arrangements enable a flow of 5 μg/sec of H to give full-scale deflection of a 60 μA recorder. The instrument is linear to 20× this value, is independent of pressure and, within limits, of temperature. Accuracy and stability $\simeq \frac{1}{2}\%$. Only the tube comes into contact with the gas.

533.275 : 551.508.71 2058

Theory, construction and working of Mahajan's humimeter. MAHAJAN, L. D. *Indian J. Phys.*, **20**, 214–17 (*Dec.*, 1946).—A small portable direct-reading hygrometer is described. It consists essentially of a small spring balance indicating the weight of a sample of moisture-absorbing substance [Abstr. 2817 (1945)]. Approx. error, $\pm 2\%$.

533.275 : 551.508.71 2059

Investigations on absorption hygrometers at low temperatures. GLÜCKAUF, E. *Proc. Phys. Soc., Lond.*, **59**, 344–65 (*May*, 1947).—A method has been developed for the calibration of hygrometers and for measuring their response at low temperatures. Investigations have been made on gold-beater's skin as a hygrometric element, and on the electrolytic hygrometer described by Dunmore [Abstr. 406 (1940)]. Improvements concerning the response of the latter are suggested. A new optical hygrometer, based on the interference of light reflected by thin hygroscopic films, is described in detail; its advantages are temperature-independent calibration and satisfactory response down to −60°C. A.

533.5 : 621.384.6 2060

A sliding vacuum gate for the cyclotron. BOYD, G. A. *Rev. Sci. Instrum.*, **18**, 250 (*April*, 1947).

KINETIC THEORY OF GASES 533.7

533.72 : 536.633 : 539.133 2061

Heat-capacity lag measurements in various gases. HUBER, P. W., AND KANTROWITZ, A. *J. Chem. Phys.*, **15**, 275–84 (*May*, 1947).—The method previously reported [Abstr. 2061 (1946)] has been applied to a series of gases difficult to measure quantitatively by sonic methods. Measurements of the relaxation times of the vibrational energy of H_2O, N_2, N_2 catalyzed by H_2O, and CCl_2F_2 are presented. The existence of a measurable lag in the adjustment of the rotational heat capacity of H_2 has been confirmed, and measurements of its relaxation time are presented. A.

VIBRATIONS . ACOUSTICS 534

534.114 = 5 2062

Procedure for keeping the frequency of a tuning fork constant by varying temperature, and the application to the design of an Al tuning fork. MANFREDI, A. *Ric. Sci.*, **14**, 45–50 (*Jan.*, 1943) *In Italian.*—One device consists in surrounding each prong with a tube carrying a heavy flange at its lower end. Temperature increase displace the weight and thus increases the frequency. The secon device is a cross-bar between the prongs, which o increasing temperature exerts pressure on the prong Temperature/frequency diagrams are shown for tunin forks of various metals with and without compensatio Experiments on an Al fork, compensated by exerting tension on the prongs by means of a steel wire, a described. J. A. V

534.121.2 : 534.231.3 = 5 20

On the motion of an elastic membrane coupled to a acoustic system. BORDONI, P. G. *Ric. Sci.*, **13**, 820- (*Dec.*, 1942) *In Italian.*—The equations of motion of membrane coupled to an acoustic impedance are solve and an analytic expression is given for the value of suc an impedance that would render the amplitude of th forced vibrations of the membrane independent of th frequency. Physically, this is possible only by reducin the amplitude for all frequencies, but practical solutio approximating to the theoretical conditions are discusse J. A. V

534.131 : 539.32 *see Abstr.* 2266

534.133 : 532.123/.13 *see Abstr.* 2042

534.133 : 537.228.1 20

Torsional oscillations in quartz plates. RAMACHANDR RAO, S. *Proc. Indian Acad. Sci. A*, **25**, 195–200 (*Fel* 1947).—Methods favourable for producing shear mod in quartz plates and communicating them to a liquid get diffraction patterns; methods of obtaining vario types of asymmetry of field by different kinds of silverin on the surfaces of the crystal plate; and of introducin varying degrees of error in the orientation of the X-c quartz plates, have been investigated. W. R.

534.133 : 621.396.611.21 : 621.3.012.8 = 4 20

Calculation of equivalent circuit constants of quar crystals vibrating in shear (CT, DT cuts). DUMESNIL, *Onde Élect.*, **27**, 42–4 (*Feb.*, 1947) *In French.*—The co stants are calculated from the general equations motion of a plate of infinite extent, and damping neglected. The values are in good agreement with tho observed. H. J. H.

534.212 20

Propagation of waves over the surface of a circul cylinder of infinite length. MINDLIN, J. A. *C.R. Acc Sci. URSS*, **52** (*No.* 2) 107–10 (1946).—The frequen equation of the waves is deduced and used to show th the velocity of the surface wave approaches that Rayleigh's wave as $va \to \infty$ (v = frequency, a = cylind radius). The frequency equation has one and only o root if the velocity of the surface wave < that of t transversal wave, but > that of Rayleigh's wave. L. S.

534.22 20

Very high frequency sound velocities in acetone wa mixtures. RAMACHANDRA RAO, B. *Proc. Indian Acc Sci. A*, **25**, 190–4 (*Feb.*, 1947).—Measurements of sou velocities at a frequency of 64·36 Mc/s reveal anomalous increase in velocity of H_2O to 1 583 m/s at 24 wt % of $COMe_2$. This is tentatively explained assuming that $COMe_2$ depolymerises H_2O molecules. W. R.

534.22 = 5 20

The influence of viscosity and thermal conductivity the propagation of sound. POSSIO, C. *Atti. Acc Torino*, **78** (*Tomo I*) 274–92 (1942–43) *In Italian.*— mathematical analysis is made of the propagation of sound pulse in a gas possessing viscosity and therm conductivity. Expressions are given for the velocity

ropagation of the wave-front, and the variation of the elocity with distance is shown graphically in a particular ase. L. S. G.

534.22 : 534.321.9 : 532.12 = 3 2069

Velocity of supersonic waves in mixtures of organic uids. TUOMIKOSKI, P., AND NURMI, U. *Comment. hys. Math. Helsingf.*, **10** (*No.* 11) 20 *pp.* (1940) *In erman.*—By measuring the velocity of supersonic waves n mixtures of common organic liquids, the adiabatic ompressibility-density relations are deduced and are uoted in tables. H. J. H. S.

534.22 : 534.321.9 : 539.32 : 548.0 = 3 2070

Determination of elastic constants of alkali halide rystals by means of supersonics. NURMI, U. *Comment. hys. Math., Helsingf.*, **11** (*No.* 5) 39 *pp.* (1942) *In erman.*—An accurate method based on the measure- ent of the velocity of supersonic waves in crystals is escribed for obtaining the elastic constants (adiabatic nd isothermal) of NaCl, NaBr, KCl, KBr and KI. H. J. H. S.

534.22 : 536.48 2071

The Landau velocity in liquid helium II. GOGATE, D. V., ND PATHAK, P. D. *Proc. Phys. Soc., Lond.*, **59**, 457–61 *May*, 1947).—A simple derivation of Landau's expres- ion for the second velocity of sound (in addition to he usual velocity $\sqrt{(dp/d\rho)}$) in He II is given from general hysical principles. A.

534.222.2 = 4 2072

The motion of air due to a strong explosion. SEDOV, . I. *C.R. Acad. Sci. URSS*, **52** (*No.* 1) 17–20 (1946) *In rench.*—Formulae are given for the velocity and position f the shock wave when the latter is spherically or axially ymmetric or plane. Differential equations describing the notion of the air are set up and solved in a special case nd diagrams are given of the variation of the velocity, ensity and pressure of the air behind a shock wave. L. S. G.

534.222.2 = 4 2073

On explosions in a plastic compressible medium. ALTSCHULER, L. V. *C.R. Acad. Sci. URSS*, **52** (*No.* 3) 99–202 (1946) *In French.*—A mathematical analysis is nade of spherical waves due to the explosion. The ressure and wave velocity are calculated. L. S. G.

534.222.2 = 4 2074

On the problem of a free shock wave. GERMAIN, P. *.R. Acad. Sci., Paris*, **224**, 1050–2 (*April* 9, 1947) *In rench.*—Relations are deduced for the 2-dimensional low of a uniform stream through a shock wave. G. J. K.

534.231 2075

The energy equation in acoustics of moving media and ome of its applications. SHIROKOV, M. F., AND FRAD- INA, E. M. *C.R. Acad. Sci. URSS*, **52** (*No.* 1) 29–32 1946).—The energy equation is set up and applied to the ound field acting upon a moving sound receiver (e.g. one xposed to a wind or connected to an aircraft). A ormula is deduced for the sound intensity registered by he receiver and a polar diagram of the distribution of ound intensity in the space surrounding the source is onstructed. A general formula for the Doppler effect s established. L. S. G.

534.231.3 : 534.121.2 = 5 *see Abstr.* 2063

534.232 : 532.528 2076

The acoustical concomitants of cavitation and boiling, roduced by a hot wire. I–II. OSBORNE, M. F. M., AND HOLLAND, F. H. *J. Acoust. Soc. Amer.*, **19**, 13–29 (*Jan.*, 1947).—Describes the properties of a simple, low-power nderwater noise generator—a wire heated by a heavy lectric current. The dependence of the sound generated upon frequency, input power, wire size, material, and wire history has been determined. The sound has a very broad frequency distribution. For small wires a large part of the sound is supersonic. About 1 p.p.m. of the input electrical energy appears as sound. With increasing electric power the sound power passes through a broad max. The sound is primarily a cavitation noise and can be ascribed to the continuous formation and collapse of vapour cavities. Many of the phenomena of cavitation, including corrosion, have a counterpart in boiling. Under certain conditions the hot wire has two stable forms of operation for the same input power. In one the wire is relatively cold, and the sound emitted has a broad frequency distribution. In the other the wire is red hot, and for some liquids the sound emitted is a single pure tone—a whistle of 1 000–2 000 c/s. Swishing the wire through the liquid increases the intensity of this whistle. A.

534.232 : 621.395.6/.8 2077

A general theory of passive linear electro-acoustic transducers and the electro-acoustic reciprocity theorem. I–II. FOLDY, L. L., AND PRIMAKOFF, H. *J. Acoust. Soc. Amer.*, **17**, 109–20 (*Oct.*, 1945); **19**, 50–8 (*Jan.*, 1947).—A theory of operation is developed on the basis of the most general linear (integral) equations relating the pressure and normal velocity at each point on the transducer surface and the voltage and current at its terminals. These, together with the appropriate solutions of the wave equation expressed through the use of Green's functions for the immersing medium and the equations defining the electrical termination of the transducer, completely characterize its behaviour and allow explicit calculation of impedances, responses, etc., in terms of 4 parameters. On considering a transducer to be comprised of media characterized by appropriate linear constitutive relations between stress, strain, electric and magnetic polarization, charge and current density, and electric and magnetic field intensity, one can establish the validity of the linear and reciprocity relations provided that certain sufficient conditions are met, namely: (1) that the coefficients in the constitutive relations satisfy certain "symmetry conditions"; (2) that no magneto-strictive media and no static magnetic field are present in the transducer (i.e. that the coupling is purely electrostatic or piezo-electric or both), or that no piezo-electric media and no static charge density are present (i.e. that the coupling is purely electromagnetic or magneto-strictive or both); (3) that the transducer does not radiate electromagnetic waves from its surface. A.

534.3 = 5 2078

New investigations on the acoustic characteristics of the piano. MANFREDI, A. *Ric. Sci.*, **13**, 804–19 (*Dec.*, 1942) *In Italian.*—A number of upright pianos of different quality were examined in a non-reverberating chamber at const. temperature and humidity. The effects of the various resonating cavities were measured by a piezo-electric microphone and amplifier throughout the key-board. The decay of sound intensity after striking a string differs from one note to another, is not logarithmic and often exhibits ripples; the time required for a decrease of 30 db, when considered over the whole keyboard, shows 3 distinct regions separated by deep minima, the "duration" of a note being max. in the bass (up to 10·2 c/s), and least in the treble. The effect of humidity was also studied. J. A. W.

534.3 = 5 2079

New results obtained in the study of the harmonic cavity of violins by electro-acoustic methods. PASQUALINI, G. *Ric. Sci.*, **14**, 111–27 (*Feb.–March*, 1943) *In Italian.*—A

previous investigation [*Ric. Sci.*, **11**, 622 (1940)] is summarized, and a series of tests on the effects of various parts of the body of the violin on the acoustic power, sensitivity, response and acoustic spectrum of the instrument is described. Violins with metallic bottoms of varying thickness were examined. Conclusions of importance for the design of a good violin are stated in detail. J. A. W.

534.321.9 : 532.12 : 534.22 = 3 *see Abstr.* 2069

534.321.9 : 535.42 *see Abstr.* 2117

534.321.9 : 541.127.1.08 = 82 *see Abstr.* 2289

534.321.9 : 548.0 : 539.32 : 534.22 = 3 *see Abstr.* 2070

534.321.9 : 578.088.2 : 621.396.615 2080

Ultrasonic generator. SMITH, F. W., JR., AND STUMPF, P. K. *Electronics*, **19**, 116–19 (*April*, 1946).—[Abstr. 2075 B (1947)].

534.414 : 534.642 = 5 *see Abstr.* 2082

534.614 : 541.64 : 541.24 *see Abstr.* 2297

534.614 : 620.172.225 : 679.5 : 539.32.082.4 *see Abstr.* 2268

534.62 = 3 2081

Sound-damped research room. MÜLLER, A. C., AND MÜLLER-STROBEL, J. *Schweiz. Bauztg.*, **65**, 247–51 (*May* 10, 1947) *In German.*—The paper describes in detail the design and performance of a room for sound research. Apart from normal features, the lining of sound absorbent wool is corrugated in waves, the section of each corrugation being approximately triangular. In the range of frequencies 70 to >7 000 c/s the absorption coefficient of the room >0·9. A. B. W.

534.642 : 534.414 = 5 2082

Measurement of normal acoustic impedance by a resonance method with frequency variation. NUOVO, M. *Ric. Sci.*, **14**, 183–200 (*April*, 1943) *In Italian.*—A cylindric tube of metal is brought to resonance (1) when closed with a rigid piston, (2) when closed with the surface of the test piece. The theory is developed in full, possible errors arising from simplifying assumptions are investigated, and the analogy of the tube to an electric transmission line is traced. Resonance curves and observation results are given. J. A. W.

534.843 2083

Normal frequency spacing statistics. BOLT, R. H. *J. Acoust. Soc. Amer.*, **19**, 79–90 (*Jan.*, 1947).—The decay of sound in rooms is characterized by small-scale modulations which influence hearing conditions in a manner not completely describable in terms of average decay rates. The steady-state frequency response of a room is irregular in nature. Rooms have consequently been proportioned to minimize "piling up" of resonance frequencies and consequent increased roughness of response. Fluctuations are particularly prominent if the ratio of room dimensions to wavelength is low and it becomes quite unrealistic to deal only with smooth average expressions in such cases. Consequently there arises a need for dealing with "average fluctuation properties." The paper develops a statistical theory on this basis, using dimensionless parameters to yield results which are independent of room volume but dependent explicitly on room shape. A. B. W.

534.88 : 621.395.615 2084

Sonar for submarines. LANIER, R. S., AND SAWYER, C. R. *Electronics*, **19**, 99–103 (*April*, 1946).—A listening apparatus consisting of a magnetostriction hydrophone feeding into an l.f. amplifier with presentation by headphone, loudspeaker and magic eye. The hydrophone, which can be trained from within the submarine, consists of a Ni tube, 3 ft long by 2 in dia., within which is wound the pickup coil on a Si-steel core. The frequency characteristic can be varied, and a supersonic convertor enables signals from 8 to 65 kc/s to be detected. The system has a sensitivity margin of about 20 db above water-noise level. H. G. M. S

OPTICS . RADIATION . SPECTRA 535

535.1 = 4 208

The propagation of light in an electrostatic field. GIÃO, A. *C.R. Acad. Sci., Paris*, **224**, 1212–14 (*April* 21, 1947) *In French.*—A novel electro-optical effect—the bending of light rays by an electrostatic field analogous to the Einstein deviation in a gravitational field—is derived from the author's synthesis of general relativity and wave mechanics [Abstr. 2018 (1947)]. The formula derived for the deviation of the rays appears to be capable of experimental verification. V. C. A. F

535.23.08 : 536.33 = 3 208

The performance limits of heat radiation instruments. KAPPLER, E. *Z. Naturforsch.*, **1**, 560–4 (*Oct.*, 1946) *In German.*—In a theoretical paper of the same title Dahlke and Hettner [*Z. Phys.*, **117**, 74 (1941)], have shown that the limits of sensitivity of a bolometer are governed by the spontaneous temperature fluctuations of the instrument. They introduced the conception of an "optimum efficiency" L, for which they obtained the value $1/T\sqrt{(2k\lambda)}$ (λ = emissive power) for the case when the measurement time is of the same order as the response time of the bolometer. The mean error due to the spontaneous fluctuations is now shown to have been incorrectly calculated, and the corrected expression is $L = 1/T\sqrt{(2kC)}$ (C = heat capacity), showing that, in order to obtain a bolometer with the highest possible efficiency, attention should not be paid to the emissive power, but the heat capacity should be made as small as possible. S. W.

535.234 : 523.165 : 537.591 = 3 *see Abstr.* 2174

535.241 : 53.081.3 208

Changes in photometric units. *J. Opt. Soc. Amer.*, **37**, 402 (*May*, 1947).—Description and discussion of the new Standard Candle [see Abstr. 1421 (1947)].

535.243 : 535.372 208

A sensitive photo-electric method for determining the chromaticity of phosphorescent and fluorescent materials. PLYMALE, W. S., JR. *J. Opt. Soc. Amer.*, **37**, 399–40 (*May*, 1947).—A multiplier photo-tube is used without multi-stage amplifiers in connection with a constant deviation monochromator to determine the spectral energy distribution for sources having low brightness. The convenience and sensitivity gives a marked advantage over the spectrographic method.

535.243 : 545.828 *see Abstr.* 2316

535.317.1 : 535.41 *see Abstr.* 2115

535.321.5 208

Measurements of the refractive index of films. BILLMEYER, F. W., JR. *J. Appl. Phys.*, **18**, 431–4 (*May* 1947).—The film (thick or thin, transparent or translucent; coloured, surface only fair optical quality) is immersed in a liquid mixture, and the intensity of reflected light observed as the refractive index of the liquid is varied. The refractive index of the film, corresponding to a minimum on the curve, can be found to ±0·002 unit.

535.323 : 549.211 : 535.551 *see Abstr.* 2120

535.33 : 537.531 *see Abstr.* 2162–3

535.33 : 537.531 : 539.11 *see Abstr.* 2190

535.33 : 539.132 *see Abstr.* 2192

535.33/.34 : 545.82 *see Abstr.* 2308

535.33.03 : 545.822 *see Abstr.* 2313–14

535.331 : 539.153 *see Abstr.* 2210

535.338.334 : 535.343.4 *see Abstr.* 2101

535.338.334 : 535.343.4–14 *see Abstr.* 2105

535.338.334 : 621.315.611.029.6 : 537.226 *see Abstr.* 2145

535.338.4 : 535.372 2090

Emission bands of halogens. II. Iodine bands arising in $_g(^3\Pi_{1g})$ and $\Pi_{2,1g}$ states. VENKATESWARLU, P. *Proc. Indian Acad. Sci. A*, **25**, 119–32 (*Feb.*, 1947).—For I, see Abstr. 1470 (1947). Wavelengths of all diffuse bands from 2 600–4 800 Å are listed. The bands occur in groups involving frequency changes of 165, 215 and 360 cm^{-1}. Five groups of each of the last two types are shown to arise from two initial stable states with frequencies of 215 and 360 cm^{-1} to a common set of five different final states, all unstable but comprising the only theoretically possible states. The continuum at 3 416 Å is due to the transition $1_g(^3\Pi_{1g}) \rightarrow 0_u^-(^1\Sigma_u^-)$ in the I_2 molecule. Fluorescent bands corresponding with the emission bands are discussed. W. R. A.

535.338.4 2091

Emission bands of halogens. III. Iodine bands arising in $_u(^3\Sigma_u^+)$ and $1_g(^1\Pi_g)$ states. VENKATESWARLU, P. *Proc. Indian Acad. Sci. A*, **25**, 133–7 (*Feb.*, 1947).—Broad bands at 4 747·2, 4 662·1 and 4 575·2 Å are explained by transitions from a single stable $1_u(^3\Sigma_u^+)$ state at 44 900 cm^{-1} to three unstable states, $0_g^+(^3\Sigma_g)$, $1_g(^3\Sigma_g^-)$ and $1_g(^1\Pi_g)$, which dissociate into $^2P_{3/2} + {}^2P_{1/2}$ iodine atoms at 20 037 cm^{-1}. Bands in the region 2 687 to 2 400 Å form three groups which are explained as arising to a level $1_g(^1\Pi_g)$ at 58 572 cm^{-1} and having unstable $1_u(^3\Delta_{1u})$, $2_u(^3\Delta_{2u})$ and $1_u(^1\Pi_u)$ final states. The potential energy diagram for I_2 is given. W. R. A.

535.338.4 2092

Emission bands of halogens. IV. Diffuse bands of bromine. VENKATESWARLU, P. *Proc. Indian Acad. Sci. A*, **25**, 138–50 (*Feb.*, 1947).—A large number of new diffuse bands in the emission spectrum of Br are reported. Bands between 2 000 and 4 200 Å occur in different sets of groups involving frequency differences of 330, 229 and 480 cm^{-1} and arising, as for iodine, in the $1_g(^3\Pi_{1g})$(55 534 cm^{-1}), $1_g(^1\Pi_g)$(61 444) and $\Pi_{2,1g}$(66 500) states with, in each case, a repulsive final state. Further, there are nine broad bands arising from $1_u(^3\Sigma_u^+)$ (47 000 cm^{-1}) to nine repulsive final states. W. R. A.

535.338.4 : 523.873 *see Abstr.* 2010

535.338.42 2093

Errata: "Vibrational frequencies of the isotopic water molecules; equilibria with the isotopic hydrogens." LIBBY, W. F. *J. Chem. Phys.*, **15**, 339 (*May*, 1947).—Abstr. 1933 (1943).

535.338.42 : 539.133 = 4 *see Abstr.* 2197

535.343.2–31 2094

Ultra-violet absorption band-systems of PbO, PbS, PbSe and PbTe. VAGO, E. E., AND BARROW, R. F. *Proc. Phys. Soc., Lond.*, **59**, 449–57 (*May*, 1947).—The vibrational analysis of new band-systems of PbS, PbSe and PbTe are reported, together with some observations on systems of PbO ($v_e \sim 35\,000$) and of PbSe ($v_e \sim 24\,818$ cm^{-1}) already known. A.

535.343.3–15 : 539.133 2095

Infra-red spectra of monomeric formic acid and its deuterated forms. I. High frequency region. WILLIAMS, VAN Z. *J. Chem. Phys.*, **15**, 232–42 (*May*, 1947).—The hydrogen and deuterium stretching vibrations of the molecules HCOOH, HCOOD, DCOOH and DCOOD have been studied with a high resolution echelette-grating infra-red spectrometer from 4 000–2 000 cm^{-1}. From the rotational structure of these bands parameters which are functions of the moments of inertia have been calculated. From these parameters, previous data, and assumptions of the H bond distances and molecular planarity, the following dimensions of the molecule have been derived: O—H, 0·96 ± 0·01; C—H, 1·08 ± 0·01; C=O, 1·225 ± 0·02; C—O, 1·41 ± 0·02 Å; O—C=O, 125 ± 1°; C—O—H, 107 ± 5°; H—C=O, 122 ± 5°. A.

535.343.3–15 : 539.133 2096

Infra-red spectra of monomeric formic acid and its deuterated forms. II. Low frequency region (2 200–800 cm^{-1}). WILLIAMS, VAN Z. *J. Chem. Phys.*, **15**, 243–51 (*May*, 1947).—Consideration is given to the possibility of the existence of a *trans*-form of the molecule. The bands observed are not sufficiently regular in appearance or absorption frequency to permit assignment of vibrational modes without further knowledge of the spectra. A.

535.343.3–15 : 539.133 *see Abstr.* 2198

535.343.3/.4–15 = 4 2097

Infra-red absorption spectra of the methyl alcohols CH_3OH, CH_3OD, CD_3OH and CD_3OD, liquid and vapour (3 to 15 μ). COURTOY, C. *Ann. Soc. Sci., Brux.*, **61** (*Sér.* 1) (*No.* 2) 139–47 (1947) *In French.*

535.343.3/.4–15 : 535.375.55 2098

Infra-red and Raman spectrum of *cyclo*-octatetraene. FLETT, M. ST. C. *Nature, Lond.*, **159**, 739 (*May* 31, 1947).—The Raman spectrum of the liquid excited by the Hg line 5 461 Å, and the vapour and liquid absorption bands between 2 and 20 μ are listed. A number of "coincidences" between the Raman and i.r. spectra occur.

535.343.32 : 539.164.93 = 5 2099

On the absorption spectrum of irradiated benzpyrene. MILAZZO, G. *Ric. Sci.*, **14**, 243–9 (*May–June*, 1943) *In Italian.*—Absorption spectra of hexane and benzene solutions of benzpyrene which had been exposed to radioactive irradiation for a year were obtained and compared with those of non-irradiated benzpyrene. A remarkable difference in the visible region is attributed to molecular transformations, and it is suggested that the carcinogenic action of benzpyrene is due to some such transformation stimulated by radiation or other chemical or physical agents. J. A. W.

535.343.32/.4 : 532.74 = 3 2100

The absorption of light and the molecular state of iodine in the vapour phase and in solution. KORTÜM, G., AND FRIEDHEIM, G. *Z. Naturforsch.*, **2a**, 20–7 (*Jan.*, 1947) *In German.*—It is concluded from measurements of extinction coefficients that differences in colour of iodine solutions are due not to varying molecular association but to interaction with solvent. A weak band at ~ 37 500 cm^{-1} is, however, strongly dependent on concentration, and suggests the presence of molecules of higher complexity, e.g. I_4. R. F. B.

535.343.4 : 535.338.334 2101

Absorption line width in the rotation spectrum of atmospheric water vapor. ADEL, A. *Phys. Rev.*, **71**, 806–8 (*June* 1, 1947).—Grating measurements at oblique incidence are employed as a means of obtaining the narrow slits essential to the direct observation of line width. Correction for the finite width of slit is small. It is accomplished by empirical extrapolation to zero slit in one instance, and by numerical estimation of slit influence in another. The absorption coefficient ½-widths at ½-height for the lines at 18·64 μ and 15·99 μ are found to be 0·12 cm^{-1} and 0·11 cm^{-1}, respectively. A.

535.343.4–14 2102

Inversion spectrum of ammonia. STRANDBERG, M. W. P., KYHL, R., WENTINK, T., JR., AND HILLGER, R. E. *Phys. Rev.*, **71**, 639 (*May* 1, 1947).—A previous discrepancy [Abstr. 1483–4 (1947)] is removed by a computational correction. W. E. D.

535.343.4–14 2103

Nuclear quadrupole moment effects in the microwave spectrum of ammonia. WATTS, R. J., AND WILLIAMS, D. *Phys. Rev.*, **71**, 639 (*May* 1, 1947).—Measurements on satellites have been extended up to $J = K = 7$ and are in good agreement with theory [Abstr. 1181 (1947)]. W. E. D.

535.343.4–14 2104

Microwave spectra: the hyperfine structure of ammonia. GORDY, W., AND KESSLER, M. *Phys. Rev.*, **71**, 640 (*May* 1, 1947).—The method makes use of a single crystal unbalanced detecting system and 12-m waveguide absorption cell. The source is modulated by a slowly changing reflector voltage, and a l.f. filter in the amplifier permits the detection only of the sudden changes in output occasioned by an absorption line. Small satellites of many of the lines near 1·25 cm have been resolved. W. E. D.

535.343.4–14 : 535.338.334 2105

Collision broadening of the inversion spectrum of ammonia at centimetre wave-lengths. I. Self-broadening at high pressure. BLEANEY, B., AND PENROSE, R. P. *Proc. Phys Soc., Lond.*, **59**, 418–28 (*May*, 1947).—The absorption spectrum between 0·6 and 0·9 cm^{-1} has been measured at pressures up to 60 cm Hg. From the previous analysis of the fine structure, and the measurement of the widths of the lines at a pressure of 0·5 mm Hg, the shape of the absorption curve at high pressures has been computed assuming that the widths vary accurately as the first power of the pressure. At a pressure of 10 cm Hg, the computed and observed curves agree within the experimental error; at 60 cm Hg, the observed attenuation at the lower frequencies is somewhat greater than that computed. Possible reasons for this phenomenon are discussed. A.

535.343.4–14 : 539.133 *see Abstr.* 2199

535.37 : 778.33 *see Abstr.* 2367

535.371 2106

The mechanism of the luminescence of solids. WILLIAMS, F. E., AND EYRING, H. *J. Chem. Phys.*, **15**, 289–304 (*May*, 1947).—An attempt is made to explain various luminescent properties by a simple model of potential energy *v.* configuration co-ordinate. Three states of different multiplicities are involved. The luminescent process consists of the excitation of an electron to a metastable level, activated release of the electron to the emitting level and a forbidden transition between the emitting and the ground state; with high excitation energy, the metastable state is by-passed. At high temps., the electron in the metastable state surmounts a larger potential barrier to undergo radiationless recombination with the activator atom. Experimental observations were made on various phenomena and treated quantitatively on this model. A detailed theoretical analysis of "glow curves" is presented, and applied to improved curves obtained at rates of heating 100 times slower than those previously reported. It is concluded that glow curves result from discrete metastable states that are emptied thermally by predominantly monomolecular kinetics. A.

535.371 2107

The short period time variation of the luminescence of a zinc sulphide phosphor under ultra-violet excitation. LORD, M. P., REES, A. L. G., AND WISE, M. E. *Proc. Phys. Soc., Lond.*, **59**, 473–502 (*May*, 1947).—The photographic method for measuring the blue phosphorescent intensity over ~300 msecs from the end of irradiation is described. The variation found with a phosphor containing Ag and Cu impurities corresponded to a bimolecular law with two types of activating centre, whose constants are worked out; the centre with faster decay is identified as Ag, and the other as interstitial Zn. Cu centres give a very slowly decaying green band. Variations of the constants with temp. and exciting intensity can be explained by assuming trapping centres associated with each excited activating centre. The effect of layer thickness on the decay law is also considered. A.

535.371 2108

Fluorescence of solid anthracene. BOWEN, E. J., AND MIKIEWICZ, E. *Nature, Lond.*, **159**, 706 (*May* 24, 1947).—The change from blue to green by the addition of naphthacene was investigated with sols prepared by simultaneous precipitation, and by separate precipitation and mixing, of anthracene and naphthacene. The similar behaviour of the former, and the different of the latter, to solid solutions made by fusion are strong evidence in favour of the "exciton" hypothesis [Abstr. 2938 (1945)].

535.371 : 535.82 *see Abstr.* 2126

535.371 : 621.327.43 2109

Notes on the stability of phosphors under ultra-violet irradiation. MEISTER, G., AND NAGY, R. *J. Opt. Soc. Amer.*, **37**, 403 (*May*, 1947).—Earlier communications [Abstr. 298, 839 (1947)] are discussed, and further observations described, which support the authors' views.

535.372 2110

Tetravalent manganese as an activator in luminescence. KRÖGER, F. A. *Nature, Lond.*, **159**, 706–7 (*May* 24, 1947).—Several red-luminescent systems, with unusually sharp bands, were discovered, all activated with Mn under oxidizing conditions. The valency was verified by titration or by comparison of the spectra with that of Cr^{3+}-activated fluorescence (Cr^{3+} and Mn^{4+} being iso-electronic).

535.372 : 535.243 *see Abstr.* 2088

535.372 : 535.338.4 *see Abstr.* 2090

535.372 : 621.327.43 2111

Ultra-violet phosphors and fluorescent sun tan lamps. CLAPP, R. H., AND GINTHER, R. J. *J. Opt. Soc. Amer.*, **37**, 355–62 (*May*, 1947).—Several types of alkaline earth silicates and phosphates activated with Pb or Tl were found to be capable of converting primary u.v. radiation (Hg line, 2 537 Å) to radiation in the erythemal or sun-tan region (2 900–3 200 Å). Among these a Ca phosphate activated with Tl not only showed a good initial erythemal emission, but when used in an experimental fluorescent lamp maintained a high percentage of this emission for the several hundred hours tested. In addition, similar types of phosphors were efficient in the neighbouring "black-light" region (~ 3 400–3 800 Å), and gave more emission there than Ce-activated phosphors. A.

535.375.5 2112

A Raman apparatus for quantitative polarization measurements. CRAWFORD, B. L., JR., AND HORWITZ, W. *J. Chem. Phys.*, **15**, 268–74 (*May*, 1947).—An apparatus for quantitative measurement of the depolarization factors of Raman lines is described [modification of Abstr. 1662 (1938)]. Short exposure times result from the use of 8 exciting lamps. No apparatus corrections are needed. Alignment is not critical. Performance is reported on the Raman lines of CCl_4, $CHCl_3$ and C_6H_6. A.

535.375.5 : 539.132 = 3 *see Abstr.* 2193

535.375.55 : 535.343.3/.4–15 *see Abstr.* 2098

535.39 = 4 2113

Selective and metallic reflection. ARZELIÈS, H. *Ann. Phys., Paris* (*Sér.* 12) **2**, 133–94 (*March–April*, 1947) *In French.*—Continuing earlier work on the reflection of m. waves at a plane surface [Abstr. 2573 (1946)] the neral case of reflection from absorbent media is dissed. Special cases are also dealt with, including those ith two absorbent media in contact. The treatment is tirely mathematical in character. A. H.

535.39 = 4 2114

Graphical determination of the optical properties of nple and compound sheets. COTTON, P. *Ann. Phys., aris* (*Sér.* 12) **2**, 209–32 (*March–April*, 1947) *In French.*—view of the widespread use in optics of thin films ounted on supports of different character (transparent opaque) it is important to have available a rapid ethod for obtaining the various optical constants. etails are given of a simple graphical method for acing the curves which will give the reflection and transission factors, the method being based on the e.m. eory of light. The treatment is entirely theoretical, id a variety of cases is considered for different types of m on different types of support. A. H.

535.41 : 535.317.1 2115

Observation of refractional structures. RYTOV, S., AND BOTINSKY, M. *J. Phys., USSR*, **11** (*No.* 1) 92 (1947).—modification of Toepler's method, utilizing change of ase of the primary beam as in the methods of phase icroscopy, has been successfully applied to the examinaon of microscopic refractional structures, i.e. structures hich modify the phase but not the amplitude of light assing through them. The advantages over the dark eld method (clarity of image, avoidance of doubling) e illustrated by some sample photographs.

535.42 = 5 2116

Concerning a peculiar experiment in optics. DI RANCIA, G. T. *Ric. Sci.*, **14**, 101–10 (*Feb.–March*, 43) *In Italian.*—Gouy's diffraction experiment [*C.R. ad. Sci., Paris*, **117**, 626 (1893)] is described and the ttempt at explaining the phenomenon rejecting the uygens–Fresnel principle is criticized. The theory of verse interference is developed, the experiment is given modified form and it is shown to confirm the theory. J. A. W.

535.42 : 534.321.9 2117

Hiedemann patterns at very high frequencies. BHAGAANTAM, S., AND RAMACHANDRA RAO, B. *Nature, ond.*, **159**, 742 (*May* 31, 1947).—Diffraction of light by aves of frequency up to 103·5 Mc/s in glass have been udied (longitudinal and torsional). The phenomena reviously reported [Abstr. 1195 (1947)] for liquids, when e wave front is inclined, were observed but to a lesser egree, corresponding to the increased wavelength. alues are quoted for velocities in glass at different equencies.

535.421 : 538.566 2118

Diffraction pattern of a circular aperture at short istances. ANDREWS, C. L. *Phys. Rev.*, **71**, 777–86 *June* 1, 1947).—The diffraction pattern of electroagnetic waves was studied at distances from 0 to 5 avelengths from a circular aperture. Microwaves of 2·8-cm wavelength were employed. The aperture was n iris diaphragm that could be varied between 1 and 6 avelengths in dia. The beam was incident normally pon the plane of the aperture from a 4-ft parabolic reflector 24 ft away. The sharpest diffraction patterns were in the plane of the aperture. Measurements were also made of the intensities at fixed points along the axis as the diameter of the iris was varied. It was observed that Fresnel zone theory could be employed as a rule-of-thumb in predicting the intensity along the axis even in the illogical case of predicting the intensity at the centre of the aperture. Checks were made against Kirchhoff's theory. A.

535.43 : 548.0 : 549.211 2119

Thermal scattering of light in diamond. KRISHNAN, R. S. *Nature, Lond.*, **159**, 740–1 (*May* 31, 1947).—Observations with a quartz spectrograph have confirmed the theoretical value for the Doppler shift in frequency of light scattered by diamond, arising from sound waves of thermal origin, and based on the recent [Abstr. 1039 (1947)] determination of sound velocity in diamond. The intensity of the Doppler-shifted lines increases rapidly with temperature.

535.43 : 612.84 *see Abstr.* 2354–5

535.551 : 535.323 : 549.211 2120

Photo-elastic constants of diamond. RAMACHANDRAN, G. N. *Proc. Indian Acad. Sci. A*, **25**, 208–19 (*Feb.*, 1947).—All the photo-elastic constants of diamond have been determined. Diamond is unique in having $q_{11} - q_{12}$ and q_{44} positive, and also in that the refractive index of the crystal should decrease when subjected to hydrostatic pressure. W. R. A.

535.555 2121

A generalized intensity formula for a system of retardation plates. HSÜ, H.-Y., RICHARTZ, M., AND LIANG, Y.-K. *J. Opt. Soc. Amer.*, **37**, 99–106 (*Feb.*, 1947).—A formula is deduced, by employing the new calculus [Abstr. 2083 (1941)], for a system of n plates randomly orientated between a polarizer and analyser. The result of a change of the order of the plates, and details of an experimental verification of the formula for $n = 4$, are discussed. H. G. J.

535.64 2122

Silberstein on intrinsic properties of the color domain. SINDEN, R. H. *J. Opt. Soc. Amer.*, **37**, 396–8 (*May*, 1947).—See Abstr. 1969 (1938). It is shown that Silberstein's method of introducing Fechner's law is inconsistent with his initial assumptions, and that the resulting expressions disagree fundamentally with experimental data. A.

535.65 : 621.327.43 2123

Color technology of fluorescent lamps. BUCK, G. B., II., AND THAYER, R. N. *Illum. Engng, N.Y.*, **42**, 415–34 (*April*, 1947).—[Abstr. 2008 B (1947)].

535.66 : 548.0 *see Abstr.* 2317

535.681 : 621.326 2124

Changes in hue, lightness, and saturation of surface colors in passing from daylight to incandescent-lamp light. HELSON, H., AND GROVE, J. *J. Opt. Soc. Amer.*, **37**, 387–95 (*May*, 1947).

535.81 2125

Optical silver chloride. KREMERS, H. C. *J. Opt. Soc. Amer.*, **37**, 337–41 (*May*, 1947).—This infra-red transmitting material has been developed in the form of plates, sheet, film, and special shapes. Its remarkable plasticity has been used to form it into various optical shapes not possible with other crystalline optics. Large single crystals are grown by the gradient method, and are more easily worked than is possible with the multiple cast ingot. Optical and transmission data are given. A.

535.82 : 535.371 2126

Factors in fluorescence microscopy. HAMLY, D. H., AND SHEARD, C. *J. Opt. Soc. Amer.*, **37**, 316–20 (*May*, 1947).—The primary considerations are: (1) brightness of the fluorescent image in absolute terms and (2) brightness level, image contrast and resolving power of the eye. Details concerning various contributing elements, such as brightness of u.v. radiating sources, methods of illumination, selection of optical accessories, and transmitting and absorbing filters for use with visible and u.v. radiations, are presented in the text and tables of data. A.

535.822 2127

Image formation in phase-contrast microscopy. PAYNE, B. O. *J. Sci. Instrum.*, **24**, 163–5 (*June*, 1947).—A simple theory of the phase-contrast microscope is developed on the lines adopted by Kohler and Loos [*Naturwiss.*, **29**, 49 (1941)], and this is extended to include cases in which the amplitude of the direct light can be varied continuously over a range of positive and negative values. A.

535.87 2128

Making Fresnel off-axis parabolic mirrors by the evaporation technique. SCHULZ, L. G. *J. Opt. Soc. Amer.*, **37**, 349–54 (*May*, 1947).—A technique was worked out for making Fresnel off-axis parabolic mirrors by selective evaporation of Al on to spherical mirrors. Tests were made to determine the extent and the nature of the interference between the light reflected from the different zones. When the illuminating slit was parallel to the principal radius there was no undesirable interference and no appreciable reduction in resolving power. A.

HEAT 536

536.1.081 2129

The thermal Ohm, Farad and Henry. BOSWORTH, R. C. L. *Phil. Mag.*, **37**, 803–8 (*Nov.*, 1946).—Definitions of these units are given on the basis of an analogy between heat flow and electric current. This anology exists only if entropy is taken as analogous to electric charge. L. S. G.

536.212.3 : 662.998 = 5 2130

Tests on thermal conductivity at low temperature. CODEGONE, C. *Ric. Sci.*, **13**, 704–8 (*Nov.*, 1942) *In Italian.*—A report on tests on glass fibre insulating material by the temperature-drop method, using thermoelectric temperature measurements and cooling of one side of the specimen plate by solid CO_2. The conductivity at a temperature difference −35 to −55°c for one sample was 0·023 kcal m^{-1}. J. A. W.

536.222 : 532.7 2131

Temperature and pressure variation of heat conductivity of liquids on Osida's theory. MOHANTY, S. R. *Curr. Sci.*, **16**, 55 (*Feb.*, 1947).—This theory [Abstr. 4080 (1939)] is shown to lead to a negative temp. coeff., and a positive pressure coeff. of heat conductivity (confirmed by Bridgman for many liquids, except water). The anomalous behaviour of water is due to its association; the complexes dissociate in the hot regions, absorbing heat, and recombine in the cold, liberating heat, and thereby increase the conductivity. Also the smaller units existing at higher temps. have a higher vibration frequency.

536.242 = 4 2132

Similarity relations in the transmission of heat through a heterogeneous body consisting partly of a gas. BRUN, E., AND DEVIENNE, M. *C.R. Acad. Sci., Paris*, **222**, 1276–7 (*May* 27, 1946) *In French.*—The problem is to determine how the coefficient of heat transmission (λ) through a cellular material (e.g. porous or fibrous) depends on the various parameters of the system. Let λ_s and λ_g be the coefficients of conduction for the solid and gaseous components of the material, and r and a two lengths associated with the solid and the gas (these are related to the geometry of the material). It is shown that $\lambda/\lambda_s = \phi(a/r, \lambda_g/\lambda_s)$, and a particular example is given. The situation with solid and gas interchanged (e.g. a powder) is also discussed, but this is more complex. L. S. G.

536.33 : 535.23.08 = 3 *see Abstr.* 2086

[536.421.1 + 536.652] : 532.7 213

A note on fusion and the hole-theory of liquids. CHOWDRI, A. G., AND AULUCK, F. C. *Phil. Mag.*, 37 809–11 (*Nov.*, 1946).—The results of a previous paper [Abstr. 2746 (1945)] are applied to a calculation of the melting point and the heat of fusion of a number of substances, e.g. K, Na, Hg, Zn, Sn, Cd, Pb, Tl, CCl_4, CS_2, C_6H_6, $C_6H_5NO_2$, $C_{10}H_8$, $(C_6H_5)_2NH$. L. S. G.

536.422 213

Sublimation in a Wilson chamber. CWILONG, B. M *Proc. Roy. Soc. A*, **190**, 137–43 (*May* 1, 1947).—In a cloud chamber containing dust-free air, ice particles are formed at adiabatic expansion if the final temperature is below −41·2°c, whatever the expansion ratio. In air ionized by X-rays the number of ice particles is greatly increased but the critical final temperature is unchanged. For outdoor air the limit below which ice particles appear is considerably higher. J. G. W.

536.423 : 536.753 213

Comments on the "Hildebrand Rule." HILDEBRAND, J. H., AND GILMAN, T. S. *J. Chem. Phys.*, **15**, 229–3 (*May*, 1947).—According to the rule [Abstr. 950 (1915)] normal liquids should have the same entropy of vaporization at temps at which their vapours have the same molal volume. This rule is here tested by application to two pairs of liquids with widely different liquid molar volumes but otherwise closely similar, and is found to be a closer approx. than Pitzer's rule [Abstr. 4092 (1939)]. Pitzer's assumptions are consequently questioned. The entropy of vaporization of a van der Waals' liquid $R[\log_e(V-b) - \log_e(v-b)]$ (V refers to vapour, and v to liquid) shows that equal V and equal $v-b$ should give equal entropy of vaporization. E.g. in comparing ethane and di-isopropyl, the separation of the methyl groups is more significant than the separation of the molecular centres.

536.423.1 : 533.15 *see Abstr.* 2055

536.423.1 : 551.578.1 *see Abstr.* 2350

536.44 213

On the behavior of pure substances near the critical point. RICE, O. K. *J. Chem. Phys.*, **15**, 314–32 (*May* 1947).—It has been suggested that the phenomena of condensation could be understood by considering the vapour as a system in which molecules are associating into clusters, these obeying the ordinary laws of equilibrium. One can also consider the liquid as a system in which bubbles of vapour are forming. The present paper attempts to apply these ideas to phenomena occurring in the neighbourhood of the critical point. Only thermodynamic methods are used, in conjunction with some general assumptions concerning the properties of the molecules involved. The highest temperature T_m at which a meniscus can exist is assumed to be the temperature at which the surface tension vanishes at the same time that the condition for equilibrium between liquid and vapour phases is fulfilled. It is concluded that the pressure-volume isotherm at T_m has a finite horizontal region, corresponding to the squeezing out of surface when the surface tension is zero. Above T_m there is still

process which may be called condensation, but no orizontal part to the isotherms. This is in contradiction o conclusions reached by Mayer and Harrison on the asis of their statistical theory of condensation [Abstr. 79 (1938)], but is apparently not in real contradiction to ie theory. A.

536.48 2137

On the theory of superfluidity. BOGOLUBOV, N. *. Phys., USSR*, **11** (*No.* 1) 23–32 (1947).—This paper resents an attempt to explain the phenomenon of superuidity on the basis of the degeneracy of a non-perfect ose–Einstein gas. By using the method of second uantization it is shown that in the case of small interction between molecules the low excited states of the as can be described as a perfect Bose–Einstein gas of ertain "quasi-particles" representing the elementary xcitations, which cannot be identified with the individual olecules. The special form of the energy of a quasiarticle as a function of its momentum is shown to be onnected with superfluidity. A.

536.48 : 530.145 : 532.7 *see Abstr.* 2051

536.48 : 532.7 *see Abstr.* 2052

536.48 : 534.22 *see Abstr.* 2071

536.483 2138

New cryogenic methods of using liquid hydrogen. DESORBO, W., MILTON, R. M., AND ANDREWS, D. H. *Chem. Rev.*, **39**, 403–17 (*Dec.*, 1946).—A portable ydrogen liquefier is described which operates from ylinder hydrogen and produces 3 to 5 litres of liquid H. cryostat, in which a litre of liquid H will maintain mps. from 14° to 20°K for 20 hrs, has been developed r use with a superconducting bolometer. G. L. W.

536.52 : 621.383 : 621.317.39 2139

A photo-electric pyrometer for a small high-frequency induction furnace. LAND, T., AND LUND, H. *J. Iron Steel Inst.*, **156**, 75–7 (*May*, 1947).—[Abstr. 1969 B (1947)].

536.62 : 536.653 = 3 2140

Calorimetry of heats of solution. FRICKE, R. *Z. Naturforsch.*, **2a**, 39–46 (*Jan.*, 1947) *In German.*—The onstructional details and thermal properties of a alorimeter consisting of a Ag vessel with cover, heater, irrer and thermometer are described. An Al block, lectrically heated, and fitted with a contact thermometer, rrounds the vessel, and between the vessel and block a rrent of air, maintained at the block temperature, is assed. To measure the water equivalent to within ~1%, the calorimeter is given a known amount of heat y an electrical heater, and the temperature rise, corrected r thermal leakage, is determined. S. W.

536.63 : 539.11 *see Abstr.* 2189

536.633 : 539.133 : 533.72 *see Abstr.* 2061

536.652 + 536.421] : 532.7 *see Abstr.* 2133

536.653 : 532.782 = 3 2141

On the heats of formation of KCl–KBr and KCl–RbCl olid solutions. FONTELL, N. *Comment. Phys.-Mat., Helsingf.*, **10** (*No.* 6) 9 *pp.* (1940) *In German.*—The ifference between the heat of solution of the solid olution and of a mixture of the same composition was neasured by means of a differential calorimeter. The eat of solution of a rapidly-cooled sample differed from hat of a sample annealed at 680°c for 300 hours.

A. J. C. W.

536.653 : 532.782 = 3 2142

On the influence of annealing on the heats of solution of KCl and KBr. FONTELL, N. *Comment. Phys.-Mat., Helsingf.*, **10** (*No.* 17) 6 *pp.* (1940) *In German.*—Annealing KCl at 610°c for 112 hrs and KBr at 700° for 170 hrs changes the heats of solution by about +0·02 and +0·06 cal/g; values of +0·09 and −0·21 were previously reported [Abstr. 2141 (1947)] for annealing at 680°.

A. J. C. W.

536.653 : 536.62 = 3 *see Abstr.* 2140

536.66 : 539.133 *see Abstr.* 2200

THERMODYNAMICS 536.7

536.7.081.5 = 3 2143

Temperature and entropy in dimensionally consistent units. BODEA, E. *Schweiz. Arch. angew. Wiss. Tech.*, **13**, 33–45 (*Feb.*, 1947) *In German.*—A discussion of the concept of temperature in relation to kinetic theory, in which it is shown that, by the adoption of a particular system of dimensions, the entropy of a system may be expressed as a pure number. F. E. H.

536.753 : 532.73 *see Abstr.* 2054

536.753 : 536.423 *see Abstr.* 2135

536.76 2144

An equation of state for a system with a single type of transformation. FINCK, J. L. *J. Franklin Inst.*, **243**, 117–29 (*Feb.*, 1947).—The equation, based on theory of a previous paper [Abstr. 1210 (1947)], is of the form $h = A + Bv + Cp + Dpv - T(E + Fv + Gp + Hpv)$, where $h = \varepsilon + pv$ is the total heat, p the pressure, v the specific volume, T the temperature, and p, v, T are considered independent variables. A, B, C, etc., are constants for the system. The latent heat at constant (p, T) is given by $\lambda_{p,T} = (v_2 - v_1)(\partial h/\partial v)_{p,T} = (v_2 - v_1)[(B - TF) + p(D - TH)]$. These equations are checked with data on saturated and superheated NH_3, and the agreement is good to within a few tenths %. Also, checks with data on saturated and superheated steam show agreement within several %. A.

ELECTRICITY 537

537.12 : 539.166.835 *see Abstr.* 2230

537.12 : 539.166.835 = 3 *see Abstr.* 2231

537.122 : 530.145 *see Abstr.* 2028

537.221 : 621.396.622.6 : 537.311.33 *see Abstr.* 2149

537.226 : 535.338.334 : 621.315.611.029.6 2145

Dielectric properties of solids at ultra-high frequencies. FRÖHLICH, H. *Rep. Brit. Elect. Allied Industr. Res. Ass.* (*Ref.* L/T163) 5 *pp.* (1946).—The Lorentz formula for the shape of absorption lines is shown to be incorrect except near resonance, and the correct formula previously quoted [Abstr. 286 B, 493 (1946)] is derived and discussed. It should be used when considering ultra-high frequencies. See also Abstr. 748 (1946). A.

537.226 : 539.133 *see Abstr.* 2201

537.226 : 620.197.6 : 541.135.5 *see Abstr.* 2293

537.226.1 : 539.133 2146

Dielectric constants and molecular structure. I. Dielectric constants of liquids and solids and dipole moments. KULKARNI JATKAR, S. K., YATHIRAJ IYENGAR, B. R., AND SATHE, N. V. *J. Indian Inst. Sci.*, **28 A** (*Pt II*) 1–15 (1946).—A theoretical discussion of the inadequacies of the Debye–Clausius–Mosotti equation. The correct equation for liquids, solids and solutions is $(\varepsilon - 1)M/\rho = 4\pi N(\alpha_E + \mu^2/kT)$. W. R. A.

537.228.1 : 534.133 *see Abstr.* 2064

ELECTRIC CURRENTS 537.3

537.311.31 : 539.234 2147

Metallic film formation at low temperatures. GOETZ,

A., Armi, E. L., Foster, M. G., and Anderson, A. B. C. *Chem. Rev.*, **39**, 481–95 (*Dec.*, 1946).—Lead films were evaporated on to surfaces maintained at temps down to 14°K, and the changes in conductivity during condensation and subsequently at various temperatures were observed. Films deposited at liquid H temps showed conductivity at a mean thickness of two atomic layers. After exposure, two opposing trends were observed: (*a*) destruction of film coherence—predominant above 100°K; (*b*) an increase in conductivity—predominant below 100°K. G. L. W.

537.311.32 : 548.736.453.2 *see Abstr.* 2332

537.311.33 2148

Surface states and rectification at a metal semi-conductor contact. Bardeen, J. *Phys. Rev.*, **71**, 717–27 (*May* 15, 1947).—Localized states (Tamm levels), having energies distributed in the "forbidden" range between the filled band and the conduction band, may exist at the surface of a semi-conductor. A condition of no net charge on the surface atoms may correspond to a partial filling of these states. If the density is sufficiently high, there will be an appreciable double layer at the free surface which tends to make the work function independent of the height of the Fermi level in the interior (which in turn depends on impurity content). If contact is made with a metal, the difference in work function between metal and semi-conductor is compensated by surface states charge, rather than by a space charge as is ordinarily assumed, so that the space charge layer is independent of the metal. Rectification characteristics are then independent of the metal. [See following Abstr.]. A.

537.311.33 : 537.221 : 621.396.622.6 2149

Contact potential difference in silicon crystal rectifiers. Meyerhof, W. E. *Phys. Rev.*, **71**, 727–35 (*May* 15, 1947).—The rectifying portion is the contact between a small metal point and a semi-conductor such as Si or Ge containing suitable impurities. The potential energy of a conduction electron near the contact determines the rectifying action, and its most important feature is the height of the potential barrier which the electrons have to overcome when they pass from the metal to the semi-conductor or vice versa. This has been measured using both *n*- and *p*-type Si and different metallic contacts, and is practically independent of the kind of metal used and of the structure of the Si surface. The work function differences between the same substances were obtained independently by a parallel plate condenser (Kelvin) method, but the results showed no correlation. These results are in contradiction to the present theoretical model of the rectifier. A.

537.311.33 : 537.533 *see Abstr.* 2165

537.311.33 = 5 2150

Ionic electric conductivity of fluorite lattices at a high degree of disorder. Croatto, U. *Ric. Sci.*, **13**, 830–1 (*Dec.*, 1942) *In Italian.*—A brief report on measurements on Ce dioxide in a furnace at 300°–1 400°c between Pt electrodes. At 700° the conductivity is $1{\cdot}9\times10^{-4}\ \Omega^{-1}$, greater than for oxides of other rare earths, and, as usual, it increases with temperature. Presence of other dissolved oxides raises the conductivity. J. A. W.

537.312 : 539.166.08 : 539.165.08 = 3 *see Abstr.* 2228

537.312.5 : 621.383.4 2151

Lead sulphide photoconductive cells. Sosnowski, L., Starkiewicz, J., and Simpson, O. *Nature, Lond.*, **159**, 818–19 (*June* 14, 1947).—The technique of preparation is described, and it is shown that max. sensitivity is obtained when both Pb and O impurity centres are present in sufficient quantity to cause minimum conductivity and zero thermo-electric power. A theory of the operation is outlined, which takes account of the fact that rectifying and photo-voltaic actions are sometimes observed, and assumes the existence of neighbouring regions of C impurities (defect semi-conductor) and Pb (excess semi-conductor), with barrier and space-charge between them. Being randomly distributed, no rectifying or photo-voltaic effect is normally noticed, but illumination would increase conductivity.

537.312.62 215

Investigation of metals at temperatures below 1°K. Alekseyevsky, N., and Migunov, L. *J. Phys., USSR* **11** (*No.* 1) 95 (1947).—The apparatus (adiabatic demagnetization) is briefly described. The following metals were cooled to temps. between 0·06 and 0·15°K and none were found to become superconducting: Si, Cr, Sb, W, Be, Rh. Very pure U was found to be superconducting below 1·3°K.

537.312.62 215

Magnetic quenching of superconductivity. Stout, J. W. *Phys. Rev.*, **71**, 741 (*May* 15, 1947).—Measurements on the difference in heat capacity in the superconducting and normal states of Sn and Tl show a temp.-dependence consistent rather with the T^2 relation between temp. and threshold magnetic field than with the $T^{3/2}$ relation put forward by Sienko and Ogg [Abstr. 1528 (1947)]. W. E. D.

ELECTRIC DISCHARGES AND RADIATIONS 537.5

537.523.3 215

Corona from fine positive points. English, W. N. *Phys. Rev.*, **71**, 638–9 (*May* 1, 1947).—With MgO dust on the points, streamers and bursts are distinguishable down to a radius of curvature of 0·002 mm. With larger points the streamer pulses have the greater amplitude, but the amplitude of both types of pulse decreases with the radius. The duration of the streamer pulse remains constant at 0·4 μsec, whereas that of the burst pulse is variable, but generally between 100 and 300 μsec. W. E. D.

537.523.3 215

The mechanism of the negative point corona at atmospheric pressure in relation to the first Townsend coefficient. Loeb, L. B. *Phys. Rev.*, **71**, 712–14 (*May* 15, 1947).—On the basis of recent work [Abstr. 121 (1947)], it is shown that at atmospheric pressure it is permissible to compute the ionization in electron avalanches by means of the Townsend expression down to points $\sim10^{-3}$ cm radius. The phenomena resembling a glow discharge observed at atmospheric pressure with the negative point normally used, must be ascribed to ionization produced in the positive space charge fields built up at the point late in the course of pulse formation. The ionization at both positive and negative points must initially be of the Townsend type [see also Abstr. 2154 (1947)]. An explanation is also given for the equality of starting potentials of pulses from positive and negative points in air, while in pure N_2 and H_2, the negative pulses start at much lower potentials. A

537.523.4 : 621.396.821 : 551.594.221 *see Abstr.* 2351

537.523.5 = 3 215

Electrode erosion in light arcs. Holm, E., and Holm R. *Ark. Mat. Astr. Fys.*, **34 A** (*No.* 1) *Paper* 8, 13 *pp.* (1947) *In German.*—Experiments with arcing contacts breaking 3 A currents show that matter-transfer across gap = matter evaporated *less* deposit of atoms and ions assuming evaporation is proportional to quantity of electricity passed. F. L. J.

537.523.5 = 3 2157

Initial current densities. HOLM, R. *Ark. Mat. Astr. Fys.*, **34 B** (*No.* 1) *Paper* 8, 7 *pp.* (1947) *In German.*—The mechanism of high initial current densities in arcs is discussed. F. L. J.

537.523.5 2158

Note concerning the motion of arc cathode spots in magnetic fields. LONGINI, R. L. *Phys. Rev.*, **71**, 642–3 (*May* 1, 1947).—By separating out the positive ion and electron field it is shown qualitatively that although a magnetic field deflects both in the same direction the peak of the resultant of these two fields can move in the opposite direction. This is due to the much greater deflection of the electron field and, as it is opposed to the positive ion field, its greater deflection considerably alters the field distribution across the arc. W. E. D.

537.525 : 551.594.5 2159

Experiments on the aurorae. MALMFORS, K. G. *Ark. Mat. Astr. Fys.*, **34 B** (*No.* 1) *Paper* 1, 8 *pp.* (1947).—Analogous to Birkeland's original Terella experiments [Abstr. 2027 (1908)] but in addition an electric field $\perp$ to the magnetic axis of the Terella. This plays an important part in Alfvén's theory of magnetic storms and aurorae [Abstr. 651 (1944)]. The discharge in the partially exhausted chamber (10^{-3} to 10^{-4} mm Hg) is started with an electron gun, but is thereafter essentially due to an ionization process. At low pressure there is no visible discharge, but two bright rings appear round the poles slightly asymmetrically situated. The appearance and position of the rings does not greatly depend on the applied potential (500–8 000 V). The bearing of the experiments on Alfvén's theory is discussed. V. C. A. F.

537.525.83 2160

The influence of gas density and temperature on the normal cathode fall of a gas discharge in rare gases. JURRIAANSE, T. *Philips Res. Rep.*, **1**, 407–18 (*Dec.*, 1946).—The variation of the normal cathode fall for Ne, A and Ne–A mixtures was measured as a function of the gas density ε and the temp. t of the glass wall of the tube. It is shown that the variation with ε is a real and not an edge effect. The variation with t can be ascribed to a small variation in ε in the neighbourhood of the cathode. A.

537.527.4/.5 : 621.327.4 = 82 2161

Pulse discharge in inert gases. VULFSON, K. S. *Elektrichestvo* (*No.* 11) 16–23 (1946) *In Russian.*—The electrical characteristics of pulse discharges in lamps filled with A, Kr, Xe and Ne are discussed. The "plasma" resistance is measured, and the radiation intensity is shown to be proportional to applied energy and much higher than similar discharge in air. A shock wave is formed by the pulse, creates an increase of pressure and thus causes a second light flash. Two periods are considered, radiating a "spark" and an "arc" spectrum. Practical applications for stroboscopy, spectral analysis, photography of rapidly moving objects, etc., are discussed briefly. A. L.

537.531 : 535.33 2162

Search for element 87. HULUBEI, H. *Phys. Rev.*, **71**, 740–1 (*May* 15, 1947).—The experimental method of Hirsh [Abstr. 1716 (1943)] in the search for the X-ray spectrum of a stable isotope of element 87 is criticized. W. E. D.

537.531 : 535.33 2163

X-ray spectra of trans-uranic elements. FISHER, J. W., AND FLINT, H. T. *Nature, Lond.*, **159**, 741 (*May* 31, 1947).—A suggested limitation on the velocity of an electron in a Bohr orbit, based on the assumption of a minimum proper length for the world-line of an electron, is recalled [Abstr. 1182–4 (1928)]. This would make a K-ring impossible for atoms of $Z > 96$. Examination of X-ray spectra is suggested to see if the Moseley sequence shows a break near $Z = 96$.

537.531 : 535.33 : 539.11 *see Abstr.* 2190

537.531 : 539.163.2 2164

An investigation of the faint X-radiation from P^{32} and RaE. SIEGBAHN, K., AND SLÄTIS, H. *Ark. Mat. Astr. Fys.*, **34 A** (*No.* 1) *Paper* 6, 12 *pp.* (1947).—The β-radiation from P^{32} has been investigated by absorption measurements in Al. If the mass of the absorber is >500 mg/cm^2 the absorption curve is exponential. The bremsstrahlung from P^{32} and RaE in Pb radiators has been studied. No photo-line corresponding to annihilation radiation from positrons was detected, showing that pair-formation by electrons from P^{32} occurs at the most in the proportion of 5×10^{-5} positron per disintegration. A well-marked line occurs at 57·5 keV in the photo- and Compton spectra. The radiation is composed of L and M electrons released in the photo-effect by the characteristic radiation developed in the Pb radiator by the β-radiation from the P^{32} or RaE. A. J. M.

537.531.8 : 539.172.3 *see Abstr.* 2239

537.533 : 537.311.33 2165

The Schottky effect for composite semi-conductor electron emitters. MORGULIS, N. *J. Phys., USSR*, **11** (*No.* 1) 67–71 (1947).—A theoretical treatment of the Schottky effect for modern composite emitters of thermal, photo-electric and secondary electrons is given, and it is shown that several important features appear which are not present with ordinary metallic emitters. In particular, the expression derived for the change in the work function of thermionic emission differs greatly from the normal Schottky one. A.

537.533.7 2166

Čerenkov radiation counter. DICKE, R. H. *Phys. Rev.*, **71**, 737 (*May* 15, 1947).—Detection of photons with a counter similar to that proposed by Getting [Abstr. 1229 (1947)] is reported, the electrons being generated in a Pb sheet by X-rays from a betatron.

537.533.72 : 539.165.08 2167

The double focusing beta-ray spectrometer. SHULL, F. B., AND DENNISON, D. M. *Phys. Rev.*, **71**, 681–7 (*May* 15, 1947).—The spectrometer recently proposed [Abstr. 2342 (1946), 637 (1947)] has been analysed theoretically and compared with the conventional semi-circular spectrometer. In general there will exist, for all types of spectrometers, second order defocusing terms which tend to lower the resolving power, but these may be almost completely eliminated in this spectrometer by suitably shaping the magnetic field. A figure is presented showing the form of the focused image for a semi-circular, and for several cases of the double-focusing, spectrometer. The intensity of the image and the resolving power of the latter can become many times greater than the former. A.

537.533.73 : 621.385.833 : 539.27 = 4 *see Abstr.* 2261

537.533.74 : 539.23 *see Abstr.* 2260

537.533.75 : 539.165 = 3 *see Abstr.* 2227

537.534.74 2168

Cloud-chamber study of multiple scattering of protons in air. LUEBKE, E. A., KLAIBER, G. S., AND BALDWIN, G. C. *Phys. Rev.*, **71**, 657–60 (*May* 15, 1947).—Experimental evidence is presented for occasional large apparent curvatures of short range proton tracks in a cloud

chamber caused by multiple scattering in the gas. The observed curvatures agree qualitatively with the predictions of Bethe [Abstr. 989 (1947)]. A.

537.534.74 2169

The scattering of 4·2 MeV protons by protons. MAY, A. N., AND POWELL, C. F. *Proc. Roy. Soc. A*, **190**, 170–80 (July 8, 1947).—The methods (photographic) described in a previous paper [Abstr. 2616 (1944)] were applied. The angular distribution of the scattered protons was found to be isotropic, in the centre-of-mass coordinate system of the colliding particles, from 50 to 140° in the angle of scattering. A method of determining the absolute cross-section for proton-proton scattering at different energies, depending on the simultaneous recording of the protons scattered from hydrogen and from heavy nuclei, is described, and the conditions necessary for its application at higher energies are discussed. A.

537.534.74 2170

The scattering of 4·2 MeV protons by deuterium, helium and other light elements. HEITLER, H., MAY, A. N., AND POWELL, C. F. *Proc. Roy. Soc. A*, **190**, 180–95 (July 8, 1947).—For methods, see Abstr. 2616 (1944). The results obtained with D and He are compared with those of other experimenters with protons of different energies. The angular distributions of the protons elastically scattered by N, O and C can be simply described in terms of an *S*-component interacting with the Coulomb term in the formula for the scattered wave. Values are obtained in each case for the magnitude of the parameter which defines the amplitude and phase of the *S*-wave. The angular distribution of the protons inelastically scattered by Ne has been investigated, and evidence obtained for similar collision processes in experiments with A and Cl. A.

537.534.74 : 539.172 2171

The elastic scattering of 6·5 MeV deuterons by deuterium, helium and other light elements. GUGGENHEIMER, K. M., HEITLER, H., AND POWELL, C. F. *Proc. Roy. Soc. A*, **190**, 196–218 (July 8, 1947).—For methods, see Abstr. 2616 (1944). In the case of D, He and O the elastically scattered deuterons can be clearly distinguished at all angles of scattering from groups of particles due to other nuclear processes. In experiments with these gases it is thus possible to determine the angular variation of the scattered intensity. The results show that *P* and *D* terms make appreciable contributions to the amplitude of the scattered wave, in contrast with previous experiments with protons of approximately the same speed. With C, N and Ne, the peaks in the range distributions due to the elastically scattered deuterons are confused with those produced by protons or α-particles from (d,p) and (d,α) reactions, and the results are less reliable or are confined to restricted intervals in the angle of scattering. The *Q*-values of the reactions giving rise to the proton groups have been determined and values thus obtained of the energy of a number of excited states in the product nuclei. A study of the variation with the angle of scattering of the range of deuterons elastically scattered by helium nuclei is shown to afford a method of investigating the range-energy relation for an emulsion which has advantages over that previously employed. A.

537.542 : 539.16.08 = 4 2172

The construction of G–M counters for use with liquids. VAN HECKE, F. *Ann. Soc. Sci. Brux.*, **60** (*Sér.* 1) 224–8 (*Dec.* 12, 1946) *In French.*—Describes a double-walled Pyrex counter, with the radioactive solution held between the walls. The thin inner wall is silvered to form the cathode. It is claimed that the construction used gives good reproducibility, with plateau slope of 0·01%/V. L. E. M

537.545 2173

Velocity of propagation of the discharge in Geiger-Müller counters. WANTUCH, E. *Phys. Rev.*, **71**, 646 (*May* 1, 1947).—Results indicate a velocity about 50% less than earlier reports [*Helv. Phys. Acta*, **19** (*No.* 4) 204 (1946)]. W. E. D.

537.583 : 621.385.13.032.216 : 548.73 *see Abstr.* 2323

COSMIC RAYS 537.591

537.591 : 523.165 : 535.234 = 3 2174

On the interpretation of higher radiation [Höhenstrahlung]. JORDAN, P. *Z. Naturforsch*, **1**, 301–4 (*June* 1946) *In German.*—The radiation (primary cosmic rays) is regarded as a "black" radiation at very high temperatures (approx. 10^{12} degrees), emitted by certain very hot stars (supernovae). An examination of the empirical spectrum of the radiation shows that it conforms to a generalization of Planck's formula. The consequences of this generalization are discussed. L. S. G.

537.591.1 : 539.172 2175

Slow cosmic ray mesons at sea-level. EVANS, G. R., AND GRIFFITHS, T. C. *Nature, Lond.*, **159**, 879–80 (*June* 28, 1947).—Fifteen long tracks, probably due to protons of energy 10–20 MeV, one track, apparently of a slow meson, and a "star" of 11 charged particles, were found in photographic emulsion exposed at sea level. The proportion of mesons to protons is in rough agreement with cloud-chamber observations. The mass of the meson is calculated by two methods, giving values of $\sim$200 and $250 \pm 50\ m_e$. The disintegration star is analysed, and the incident energy estimated at 400 MeV, which may have been supplied by a fast meson.

537.591.15 2176

Penetrating cosmic ray showers at 3 860 m above sea level. BELL, L. N., BIRGER, N. G., AND VEKSLER, V. I. *C.R. Acad. Sci. URSS*, **52** (*No.* 2) 113–16 (1946).—The showers were investigated by means of special proportional counters, triple coincidences being recorded. The apparatus consisted of an amplifier of triple coincidence and 3 sets of flat proportional counters. The experiments show that at 3 860 m there exist considerably denser penetrating showers than those previously recorded, and the frequency of these showers is about 0·05% that of the hard component. L. S. G.

537.591.15 : 591.2 *see Abstr.* 2352

537.591.2 2177

The meson spectrum near sea-level. DELLA CORTE, M., FAZZINI, T. F., AND FRANCHETTI, S. A. *Nature, Lond.* **159**, 845 (*June* 21, 1947).—The calculation of Janossy and Wilson [Abstr. 3171 (1946)] is confirmed on the basis of a formula of Rose [Abstr. 989 (1945)], with (momentum)$^{-\gamma}$ substituted for (energy)$^{-\gamma}$ as the initial spectrum. The mean meson life is calculated to be 1·69 μsec.

537.591.3 = 5 2178

The absorption of cosmic rays at 2 100 m. SALVINI, G. *Nuovo Cim.*, **3**, 283–4 (*Aug.*, 1946) *In Italian.*—A preliminary report. The electron/meson ratio in cosmic rays at 2 100 m has been determined, under various thicknesses of absorbers, by measurements on shower production. L. P

537.591.5 = 5 2179

Results of periodicity analysis of cosmic radiation intensity. LOVERA, G. *Ric. Sci.*, **14**, 201 (*April*, 1943) *In Italian.*—Examination of data from Abisko (lat

° 5′) confirms the observation of a 28–29-day period bstr. 741 (1940)] of 0·57% amplitude, and reveals a rther 11·1-day (0·56%) and a 8·3-day (0·25%) period. bservations at Turin indicate also 15·3-, 5·5-, 4·3-, 8- and 2-day periods. J. A. W.

MAGNETISM 538

8.22.08 : 539.23 : 621.317.4 = 4 2180

Measurement of magnetic properties in weak alternating ids. COLOMBANI, A. *Ann. Phys., Paris* (*Sér.* 11) **20**, 5–70 (*July–Aug.*, 1945) *In French.*—A detector, con- ting of two concentric circular coils wound in opposi- n, is located at the centre of a pair of Helmholtz agnetizing coils excited from an oscillator; the specimen, micro-thin layer of Ni deposited on a glass tube 1·5 cm a., is inserted at the centre of the detector. The tector output is fed to a high-gain (up to 10^7) amplifier, ear from 50 to 150 000 c/s and so to the Y-plates of a .o., the X-plates being actuated from the exciting cuit. The detector coils having been balanced out in e absence of a specimen by a correcting voltage derived om the exciting circuit, the insertion of a specimen sults in the appearance of a hysteresis-loop on the reen. The eddy-current correction is worked out in tail; it is usually negligible for micro-layers. Measure- ents up to $H = 24$ oersted indicate marked increases in th permeability and hysteresis when a specimen has en subjected to prolonged heating; in the amorphous te the hysteresis is very small. A study of magnetic wders on similar lines is forecast. Many practical tails of the apparatus are given. G. F. F.

8.221 2181

Magnetic dispersion of γ-ferric oxide. BIRKS, J. B. *ature, Lond.*, **159**, 775–6 (*June* 7, 1947).—Previous easurements [Abstr. 385 (1947)] of complex permea- lity and permittivity at 3–9 cm wavelength have been tended to 60 cm, using powdered oxide embedded in raffin wax. A general logarithmic relation was used extrapolate values to 100% conc., and results are given a table.

8.221 : 539.4.016.2 2182

Influence of cold-working on the magnetic atomic oments in gold-chromium and copper-manganese alloys. RONQVIST, E. *Ark. Mat. Astr. Fys.*, **34 B** (*No.* 1) *Paper* 8 *pp.* (1947).

38.221 : 548.0 2183

The magnetic properties of iron pyrites. RAMASESHAN, . *Proc. Indian Acad. Sci. A*, **25**, 201–7 (*Feb.*, 1947).— he magnetic susceptibilities, χ, of 105 crystals were etermined; 95 had values between $0{\cdot}12$ and $0{\cdot}7\times10^{-6}$, between $2{\cdot}5$ and 40×10^{-6}, and 3 between 100 and 00×10^{-6}. Crystals with high χ values had low nsities, possibly owing to absence of Fe and S atoms om the crystal lattice. W. R. A.

38.24 2184

The adiabatic temperature changes accompanying the agnetization of cobalt in low and moderate fields. BATES, . F., AND EDMONDSON, A. S. *Proc. Phys. Soc., Lond.*, 9, 329–43 (*May*, 1947).—The new method [Abstr. 147 1941)] has been used in the study of annealed and nannealed Co in the form of stout wire. The observed nanges are relatively large, and in striking contrast to ose observed with Fe and Ni. An attempt is made to xplain them on the basis of modern concepts in ferro- agnetism. A.

38.245 2185

Direction of domain magnetization in powder patterns. VILLIAMS, H. J. *Phys. Rev.*, **71**, 646–7 (*May* 1, 1947).— Photographs, using colloidal magnetite particles, are shown of the (100) face of a single crystal of Fe containing 3·8% by weight of Si. The interpretation of the domain magnetization directions is aided by two new treatments —scratching, and mechanical stress. W. E. D.

ELECTROMAGNETISM . ELECTRODYNAMICS 538.3/.5

538.3 : 523.11 : 531.51 : 530.12 = 3 *see Abstr.* 2017

538.3 : 530.14 *see Abstr.* 2022

538.3 : 531.51 : 530.12 = 4 *see Abstr.* 2016

538.521.2 2186

On the outer unipolar rotation and the outer unipolar induction. KATALINIC, M. *Phil. Mag.*, **37**, 797–803 (*Nov.*, 1946).—Experiments are described which show that Faraday's experiment of revolving a wire carrying current around the end of a stationary magnet is a special case of the outer unipolar rotation and is identical with the inner unipolar rotation (Ampère's experiment). The reciprocity between the unipolar induction and the unipolar rotation is deduced. L. S. G.

538.566 : 535.421 *see Abstr.* 2118

538.566.5 : 621.392 : 517.512.4 *see Abstr.* 1997

MAGNETIC EFFECTS 538.6

538.652 2187

The dependence of the magnetostriction of nickel upon initial magnetic texture and sequence of applying magnetic field and unidirectional elastic tension. SHUR, J., AND KHOKHLOV, A. *J. Phys., USSR*, **11** (*No.* 1) 77–84 (1947).

ATOMIC AND MOLECULAR STRUCTURE 539

539 2188

Release of information on atomic energy. *Nature, Lond.*, **159**, 719 (*May* 24, 1947).—A list of 11 titles of Canadian declassified reports is given.

539.11 : 536.63 2189

Bounded linear harmonic oscillator and phase transitions of second order. SURYAN, B. *Phys. Rev.*, **71**, 741–2 (*May* 15, 1947).—Discussion of letter by Corson and Kaplan [Abstr. 1256 (1947)].

539.11 : 537.531 : 535.33 = 82 2190

Hydrogen and proton gas in metals. KRASNIKOV, A. I. *Bull. Acad. Sci. URSS, Dep. Sci. Tech.* (*No.* 1) 133–40 (1946) *In Russian.*—The problem of hydrogen in lattices of solid bodies is considered. The precision technique of secondary X-ray spectra was applied to metals, and it was found that the main spectral lines of Cr consisted of doublets. Spectra of Cr_2O_3, MnO_2, Fe_3O_4, CoO NiO, CuO and other oxides were investigated; the experiments are described. The doublet spacing measure- ments are also applied to the problem of redistribution of protons between atoms in lattices. A. L.

539.13 : 541.57 *see Abstr.* 2304

539.132 = 3 2191

On the vibrations of coupled systems of particles. MATOSSI, F., AND MAYER, R. *Naturwiss.*, **33**, 219 (*Oct.* 15, 1946) *In German.*—The effect of coupling on vibration frequencies is discussed, with special reference to SiO_4. G. J. K.

539.132 : 535.33 2192

Errata: On the dissociation energies of CO, N_2, NO, and CN. VALATIN, J. G. *J. Chem. Phys.*, **15**, 336 (*May*, 1947). [See Abstr. 403 (1947)].

539.132 : 535.375.5 = 3 2193

The structure of the ozone molecule. MELCHER, D. *Helv. Phys. Acta*, **20** (*No.* 2) 183–94 (1947) *In German.*—An experimental arrangement is described with which attempts were made to photograph Raman lines from liquid O_3 containing only a small proportion of O_2. In spite of long exposures no Raman effect was observed. The contrast of this negative result with the positive result for SO_2 is discussed in relation to the types of bonding in the molecules. L. A. W.

539.132 : 539.185.7 = 4 2194

Study of intermolecular forces by scattering of slow neutrons. Application to N_2, H_2O and KH_2PO_4. ROSSEL, J. *Helv. Phys. Acta*, **20** (*No.* 2) 105–35 (1947) *In French.*—The theory of the effect of chemical binding on the scattering cross-section is presented, and is worked out in detail for the three cases which were studied experimentally. The experiment consisted in finding the total cross-section σ with good geometry, using a Rn–Be + paraffin source and a BF_3 counter. The results showed (*a*) for N, an unexplained decrease of σ with decreasing temp., (*b*) for H_2O, a cross-section whose size and temp.-dependence suggest some rotational freedom of the molecules in the solid as well as in the liquid state, (*c*) in the KH_2PO_4 crystal, some anisotropy of proton binding at 290°K, but isotropy at 77°K. A. P. F.

539.132 : 541.57 2195

Bond energy in diatomic molecules from the force constants, nuclear distances, and classical model theory. COOK, M. A. *J. Phys. Coll. Chem.*, **51**, 407–14 (*March*, 1947).—The author's theory of the chemical bond [Abstr. 224, 1920 (1946)] which accounts for binding energy as a type of resonance interaction between the nuclei and the valence electrons, the pulsation frequency being equal to the vibration frequency, is now applied to find bond energies in diatomic molecules in terms of the experimental force constants and bond distances. The necessary equations are first developed, and computations made for diatomic molecules of like atoms, hydrides, oxides, nitrides, sulphides and halides. In view of the good agreement between the calculated and observed values, substantial support is claimed for the validity of the classical model theory. H. H. HO.

539.132 : 541.57 2196

The vibration spectrum and molecular configuration of cyclohexane. RAMSAY, D. A., AND SUTHERLAND, G. B. B. M. *Proc. Roy. Soc. A*, **190**, 245–54 (July 8, 1947).—The vibration frequencies for the carbon skeleton of the "chair" model have been calculated, using a simple valency force field and two force constants evaluated from two of the Raman frequencies. Five of these frequencies are found to agree with the observed frequencies to within 4%, while the sixth frequency is consistent with the specific heat data. The selection rules are shown to be obeyed by the assigned frequencies. The C-C stretching force constant, $3{\cdot}7\times10^5$ dynes/cm, is considerably lower than for the same bond in ethane, $4{\cdot}5\times10^5$ dynes/cm. A.

539.133 : 535.338.42 = 4 2197

Anharmonicity of the OH and OD vibrations in methyl alcohols. COURTOY, C. *Ann. Soç. Sci. Brux.*, **61** (*Sér.* 1) (*No.* 1) 66–72 (1947) *In French.*—New observations of overtone bands are reported. The following expressions reproduce the energy-levels for the O–H vibrations in CH_3OH and CD_3OH and for the O–D vibrations in CH_3OD and CD_3OD: $G_{OH} = 3\,851(v+\frac{1}{2}) - 85{\cdot}_2(v+\frac{1}{2})^2$, $G_{OD} = 2\,810(v+\frac{1}{2}) - 45{\cdot}_4(v+\frac{1}{2})^2$. R. F. B.

539.133 : 535.343.3–15 21

Infra-red spectrum of C_nD_{2n+2} and the "long-cha frequency" in paraffins. SHEPPHARD, N., AND SUTHE LAND, G. B. B. M. *Nature, Lond.*, **159**, 739–40 (*May* 3 1947).—The 14 μ band found in all normal long-cha paraffins was found to be shifted to 19 μ in the deuterat paraffin, i.e. by $\sqrt{2}$. This shows that it is due to a vibr tion of the H atoms, and not a skeletal vibration of t C atoms. [See Abstr. 1170 (1940), 659 (1947)].

539.133 : 535.343.3–15 *see Abstr.* 2095–6

539.133 : 535.343.4–14 21

Bond distances in OCS from microwave absorpti lines. DAKIN, T. W., GOOD, W. E., AND COLES, D. *Phys. Rev.*, **71**, 640–1 (*May* 1, 1947).—Bond distances calculated from the measurements are: C — O, 1·1612 $0{\cdot}0058\times10^{-8}$ cm and C — S, 1·5604 $\pm0{\cdot}0049\times10^{-8}$ cr W. E.

539.133 : 536.633 : 533.72 *see Abstr.* 2061

539.133 : 536.66 22

Heat of atomization of carbon. GOUDSMIT, S. *Natur Lond.*, **159**, 742–3 (*May* 31, 1947).—See Abstr. 661 (1947 Attention is directed to an earlier paper [Abstr. 3 (1935)] which gives 4·3 eV as the energy of the metastab ^5S level.

539.133 : 537.226 22

The effect of the solvent on dipole moment. PARANJP G. R., AND VAJIFDAR, M. B. *Indian J. Phys.*, **20**, 197–2 (*Dec.*, 1946).—The permittivity of dilute solutions propyl bromide, propyl iodide, butyl chloride, but bromide and butyl iodide was measured in each of t solvents hexane, heptane, carbon tetrachloride, benze and toluene by the method of resonance. The resul are used to calculate the apparent electric moment solution using the Debye equation and volume fraction The various empirical and theoretical relations are four suitable for representing the results. The customa extrapolation to $\varepsilon = 1$ for calculating μ_{gas} failed to gi consistent results. Extrapolating to $\varepsilon = 1{\cdot}7$ the valu obtained from the various relations are not only sel consistent but also agree with the experimentally dete mined value in the vapour state. Goss's formula [Abst 2687 (1940)] gave a better agreement than the rest.

539.133 : 537.226.1 *see Abstr.* 2146

539.152.1 22

Nuclear magnetic resonances at low temperature BITTER, F., ALPERT, N. L., POSS, H. L., LEHR, C. G., AN LIN, S. T. *Phys. Rev.*, **71**, 738 (*May* 15, 1947).—Exper ments on substances containing H and F at low temp down to that of liquid N bear out the theoretical co clusion of Bloembergen, Pound and Purcell [*Phys. Re* **71**, 466 A (1947)] on line width, viz. that in gener narrow lines are found in liquids and broad lines solids. W. E.

539.152.1 22

On the dependence of nuclear radius on the ma number. AMALDI, E., AND CACCIAPUOTI, B. N. *Ph Rev.*, **71**, 739–40 (*May* 15, 1947).—From a considerati of experimental values of nuclear radii, it is suggest that the radius depends on the number of particles in t nucleus in a rather less simple manner than previous assumed. W. E.

539.152.1 22

On the distribution of electric charge in nuclei. DAVISO B., AND WATSON, W. H. *Phys. Rev.*, **71**, 742 (*May* 1 1947).—The idea propounded by Winans [Abstr. 15 (1947)] that the protons are concentrated at the surfa of the nucleus is said to be inconsistent with the type nucleus produced at fission, as on this hypothesis t

ght fission nuclei would have a high charge mass
.tio. W. E. D.

39.152.1 = 3 2205

Analysis of the binding energies of nuclei. JENSEN, J. H., ND STEINWEDEL, H. *Naturwiss.*, **33**, 249–50 (*Oct.* 30, 946) *In German.*—Nuclear forces and stability are scussed, using graphs of excess binding energies of uclei over those of the nearest nucleus of mass number . G. J. K.

39.152.1 : 530.14 *see Abstr.* 2023

39.152.1 : 539.185.7 *see Abstr.* 2257

39.152.2 2206

Quadrupole moments and spins of Br, Cl and N nuclei. OWNES, C. H., HOLDEN, A. N., BARDEEN, J., AND TERRITT, F. R. *Phys. Rev.*, **71**, 644–5 (*May* 1, 1947).—bserved results are in good agreement with theoretical redictions, but the results very strongly suggest a spin 3/2 rather than 5/2 for the Cl nucleus. W. E. D.

39.152.2 2207

Note on the nuclear electric quadrupole spectrum of a omonuclear diatomic molecule in a magnetic field. FOLEY, . M. *Phys. Rev.*, **71**, 747–51 (*June* 1, 1947).—It is own that for very large values of the rotational uantum number J the energy of interaction of the ectric quadrupole moments of a homonuclear diatomic olecule may be expressed as the sum of the energies of ates of the single nucleus problem. This approximation ecomes less accurate for any J value as the applied agnetic field is decreased. A.

39.153 2208

Self-consistent field with exchange for the configurations $1s^22s2p^3$ and $1s^22p^4$ of carbon. JUCYS, A. *J. Phys., SSR*, **11** (*No.* 1) 49–54 (1947).—Solutions of Fock's quations are carried out. The energies of the (2*s*) (2*p*) ell are calculated. The effect of superposition of onfigurations $1s^22s^22p^2$ and $1s^22p^4$ is evaluated. A.

39.153 2209

The calculation of the co-ordinate matrix elements for elium. ROMBERG, W. *Phys. Rev.*, **71**, 706–11 (*May* 15, 947).—Formulae for the calculation of transition robabilities in an atom with two electrons are derived or transitions from discrete *s*- to both continuous and iscrete *p*-states. A.

39.153 : 535.331 2210

Electron configurations of "rare-earth" elements. EGGERS, W. F. *Science*, **105**, 514–16 (*May* 16, 1947).—t is shown that the chemical evidence for the existence f *f*-type electrons in elements is inadequate, and a review made of the spectroscopic evidence for the existence of *f* electrons in the rare-earth group ($_{58}$Ce – $_{71}$Lu), and f 5*f* electrons in the group commencing with Pa and ontaining the transuranic elements. The observed -valency of U is interpreted as participation of three 5*f* lectrons, and the valency sinks to 3 in $_{96}$Cm where the *f* electrons are more stably bound.

39.153.4 2211

Internal conversion of magnetic multipole radiation. ERESTETZKY, V. *J. Phys., USSR*, **11** (*No.* 1) 96 (1947).—*rratum.* See Abstr. 413 (1947).

39.155.2 : 539.185.7 *see Abstr.* 2258

39.155.2 : 541.123.5 *see Abstr.* 2286

39.155.2 : 541.133.1 = 3 2212

Enrichment of the heavy silver isotope by ionic migration n α-AgI. KLEMM, A. *Z. Naturforsch.*, **2a**, 9–16 *Jan.*, 1947) *In German.*—Solid α-AgI was electrolysed at 30° between a C anode and a Ag cathode for 20 hrs at n anodic current density of 2 A/cm², and the residual AgI in the neighbourhood of the anode was investigated subsequently by the mass spectrograph. At the anode the Ag consisted of 49% Ag^{107} and 51% Ag^{109}, and with increasing distance from the anode the composition changed continuously to the natural one of 52% Ag^{107} and 48% Ag^{109} at about 2·3 cm. The relation between the relative differences of the ion masses (m_1 and m_2) and the relative difference of their migration velocities (W_1 and W_2) appeared to be: $(W_1 - W_2)/\bar{W} = -0{\cdot}11(m_1 - m_2)/\bar{m}$; the older negative experiments gave for ionic migration in water a coefficient $< -0{\cdot}018$. H. H. HO.

539.155.2 : 541.23 = 3 2213

Isotopic composition and atomic weight of gadolinium. WAHL, W. *Comment. Phys. Mat., Helsingf.*, **11** (*No.* 4) 5 *pp.* (1942) *In German.*—Redetermination of the isotopic composition of Gd gives the following results: 152, 0·2; 154, 2·86; 155, 15·1; 156, 20·59; 157, 16·42; 158, 23·45; and 160, 20·87%. The mean mass no. is 157·247. Taking into account the packing fraction of $1{\cdot}5\times10^{-4}$ the chemical at. wt is 157·18. A. J. M.

RADIOACTIVITY . NUCLEAR DISINTEGRATION NUCLEAR PARTICLES 539.16/.18

539.16.08 2214

On the determination of AcX from its emanation in the presence of considerable quantities of ThX. BYSTROV, E. N. *C.R. Acad. Sci. URSS*, **52** (*No.* 2) 117–19 (1946).—The method is to observe the decay of the actinon active deposit obtained by conveying actinon for a prolonged time through an ionization chamber. A practical problem is to decrease the influence of the thoron ionization current, and apparatus for doing this is described. This employs a differential measurement circuit in two ionization chambers under a moderate velocity of the air stream. L. S. G.

539.16.08 : 519.24 *see Abstr.* 2002

539.16.08 : 537.542 = 4 *see Abstr.* 2172

539.162 = 4 2215

A physical method for detecting the inter-conversion of nuclear isomers. [Détermination de la filiation isomérique.] CAPRON, P., AND STOKKINK, G. *Bull. Acad. Belge, Cl. Sci.* (*Sér.* 5) **32** (*Nos.* 4–6) 266–86 (1946) *In French.*—The method is based on observing the shape of the curves representing the total β-radioactivity as a function of time. According to whether or not a parent-daughter relation exists between the isomers, the curves exhibit slight differences; their exact form is derived from the simple laws of radioactive synthesis and decay. The method might be used where chemical separation is impossible. A. P. F.

539.163 2216

Radioactivity of caesium. WAHL, W. *Comment. Phys, Mat. Helsingf.*, **10** (*No.* 18) 5 *pp.* (1940).—Examination of the pegmatite "Pollucite" from Veruträsk, N. Sweden, indicates the existence of Ba^{132} in this mineral. This must have arisen from a radioactive Cs^{132}. It is thus probable that the non-radioactivity of present-day Cs is due to the comparatively short life of Cs^{132} which by now has all been converted into Ba^{132}. A. J. M.

539.163 2217

Disintegration of As^{76}. SIEGBAHN, K. *Ark. Mat. Astr. Fys.*, **34** A (*No.* 1) *Paper* 7, 9 *pp.* (1947).—The energies and intensities of the β- and γ-components characterizing the disintegration of As^{76} have been determined, and a

tentative term scheme is proposed. The spin of As^{76} is 3. A. J. M.

539.163 = 3 2218

Disintegration energies of O^{19}, Na^{25}, Mg^{27}, Al^{28} and K^{42}. Bleuler, E., and Zünti, W. *Helv. Phys. Acta*, **20** (*No.* 2) 195–206 (1947) *In German.*—The limiting energies of the β-spectra of the above nuclei were determined by absorption measurements, and the disintegration schemes obtained from measurements of β–γ coincidences. The disintegration energies are O^{19}, 4·5; Na^{25}, 3·7; Mg^{27}, 2·8; Al^{28}, 4·5; K^{42}, 3·5 MeV. In the case of Al^{28} and Mg^{27} the disintegration does not lead to the ground state, but to excited levels. Excited levels of the other nuclei were also observed. A. J. M.

539.163 = 3 2219

Production of isotope 85^{218}. Karlik, B., and Bernert, T. *Naturwiss.*, **33**, 23 (*July* 15, 1946) *In German.*—The chemical separation of 87^{222} from RaA is described. The α-ray emission of the rapidly evaporated filtrate was investigated. With enrichment up to 10^5 with respect to RaA there was no indication of the characteristic α-rays of 85^{218} which would be produced from 87^{222} by α-emission. A. J. M.

539.163.1 2220

Note on the long-lived radio-iodine. Glendenin, L. E., and Edwards, R. R. *Phys. Rev.*, **71**, 742–3 (*May* 15, 1947).—Experiments indicate that the 56-day iodine decays by pure orbital electron capture, and reasons are given for assuming this isotope to be I^{125}. W. E. D.

539.163.1 2221

55-hour element 61 formed in fission. Inghram, M. G., Hess, D. C., Jr., Hayden, R. J., and Parker, G. W. *Phys. Rev.*, **71**, 743 (*May* 15, 1947).—Element 61 was separated out from fission products and examined in a mass spectrograph. A 55-hr activity was attributed to 61^{149} and a 3·7-yr to 61^{147}. Activities of Sm and Eu were assigned as follows: Sm^{153}, 47 hr; Sm^{151}, about 20 yr; Eu^{155}, 2 to 3 yr; Eu^{156}, 15·4 days. W. E. D.

539.163.1/.2 = 3 2222

Method of separation of rare earths obtained by uranium fission, by the method of Szilard and Chalmers. Götte, H. *Z. Naturforsch.*, **1**, 377–82 (*July*, 1946) *In German.*—By this method a new Ce isotope of ½-life 11 min was discovered, and, derived from it, a Pr of ½-life 25 min. The β-radiation from the Pr was much harder than that from the Ce. A short-lived rare earth isotope (3–5 min) was also found. A. J. M.

539.163.1/.2 = 4 2223

Some properties of radioactive isotopes of rhodium. Hole, N. *Ark. Mat. Astr. Fys.*, **34 B** (*No.* 1) *Paper* 5, 8 *pp.* (1947) *In French.*—Examination of the β-spectrum of Rh^{104} indicates the existence of internal conversion electrons of energy 69·5 ± 1 keV. There is a continuous spectrum with an upper energy limit of 2·60 ± 0·05 MeV. The radiation emitted by Rh^{103} is principally the *K* radiation of Rh. The ½-life of Rh^{102} is 215 ± 10 days. A. J. M.

539.163.2 2224

Disintegration of K^{42}. Siegbahn, K. *Ark. Mat. Astr. Fys.*, **34 B** (*No.* 1) *Paper* 4, 7 *pp.* (1947).—The β- and γ-radiations from K^{42} have been investigated with a β-spectrograph. The γ-radiation has energy 1·50 MeV. The upper limits of the two β-components are 3·65 and 2·04 MeV, obtained by Fermi analysis. A. J. M.

539.163.2 : 537.531 *see Abstr.* 2164

539.163.2 : 539.165.08 2225

Coincidence-spectrometry for disintegration problems. Siegbahn, K., and Johansson, A. *Ark. Mat. Astr. Fys.*, **34 A** (*Paper* 10) 19 *pp.* (1947).—Experiments on the analysis of complex β-spectra, using β–γ coincidences and scanning the β-ray spectrum with a lens-type magnetic spectrograph, are described. The 2-component spectrum of K^{42} has been analysed, and the Na^{24} spectrum has been shown to be simple, with E_{max} = 1·39 MeV. A. P. F.

539.163.2 : 539.174 2226

On the γ-radiation from polonium and from lithium bombarded with α-particles. Siegbahn, K., and Slätis, H. *Ark. Mat. Astr. Fys.*, **34 A** (*Paper* 15) 12 *pp.* (1947).—Using a lens type β-ray spectrograph, the Compton + photo-electron spectrum from Pb bombarded with Po γ-rays has been analysed and shown to derive from a single γ-ray of energy 0·773 MeV. A similar study of the γ-rays from the Li(α, $\alpha\gamma$) inelastic scattering process revealed a one-line spectrum of 0·462 MeV. A. P. F.

539.164.93 : 535.343.32 = 5 *see Abstr.* 2099

539.165 : 537.533.75 = 3 2227

A relation between energy and range for β-rays of small and medium energy. Flammersfeld, A. *Naturwiss.*, **33** 280–1 (*Nov.* 15, 1946) *In German.*—The empirical formula $E = 1{\cdot}92(R^2 + 0{\cdot}22R)^{\frac{1}{2}}$, ($E$ in MeV, R in gm Al/cm²) is shown to conform to experimental results for energies from ~50 keV to ~3 MeV. A. P. F.

539.165.08 : 537.533.72 *see Abstr.* 2167

539.165.08 : 539.163.2 *see Abstr.* 2225

539.165.08 : 539.166.08 : 537.312 = 3 2228

The measurement of β- and γ-rays by internal photo-effect in crystal phosphors. Frerichs, R., and Warminsky, R. *Naturwiss.*, **33**, 251 (*Oct.* 30, 1946) *In German.*—The results are given of experiments which show that single crystals of the sulphide, selenide and telluride of Cd give very high photo-electric currents under β- or γ-irradiation. A. P. F.

539.165.2 = 3 2229

The influence of the Coulomb field and of the electron shell on the shape of the radioactive β-spectrum. Flügge, C., and Flügge, S. *Z. Naturforsch.*, **2a**, 6–8 (*Jan.* 1947) *In German.*—It is shown that the shape of the spectrum is unaffected by the electron shell for β-ray energies >50 keV. Tables are given to show the influence of the nuclear Coulomb field as a function of Z, β-ray energy, and sign of β-particle. A. P. F.

539.165.2 : 539.18 *see Abstr.* 2245

539.166 : 539.172.1 *see Abstr.* 2238

539.166.08 : 537.312 : 539.165.08 = 3 *see Abstr.* 2228

539.166.835 : 537.12 2230

Pair production in the field of an electron. Nemirovsky, P. *J. Phys., USSR*, **11** (*No.* 1) 94 (1947).—The cross-section has been calculated by Dirac's perturbation method. The value for incident photon energy of $5{\cdot}3\ mc^2$ is $0{\cdot}4 \times 10^{-29}$ cm², which < the experimental value [Abstr. 1865 (1945)]. For large photon energies the variation of cross-section is the same as that for pair production in the nuclear field, and as the most probable process is then that with small recoil electron energy, the processes will be indistinguishable.

539.166.835 : 537.12 = 3 2231

Pair production by γ-rays in an electron field. Borsellino, A. *Helv. Phys. Acta*, **20** (*No.* 2) 136–8 (1947) *In German.*—The results of relativistic calculations are compared with earlier work by Perrin and corresponding calculations for nuclear interaction. G. J. K.

539.167.3 2232

High energy ions in crystal lattices. Aten, A. H. W., Jr. *Phys. Rev.*, **71**, 641–2 (*May* 1, 1947).—Various crystals containing either S or Cl were bombarded with neutrons

d the fate of the radiophosphorus so formed was in-
stigated by measuring the activity of the phosphates and
osphites + hypophosphites after irradiation. The
lioactive P ion tended to form a phosphate in the
stals rich in O, e.g. K_2SO_4 and $KClO_4$. W. E. D.

9.167.3 2233

Activities induced by pile neutron bombardment of narium. INGHRAM, M. G., HAYDEN, R. J., AND HESS, C., JR. *Phys. Rev.*, **71**, 643 (*May* 1, 1947).—Sm_2O_3 is examined, after neutron bombardment, in a mass ectrograph, and activity was observed at various mass mbers between 145 and 176. These are attributed to e isotopes Sm (145, 151), Eu (152, 154, 156), Gd (153), (160) or their oxides. The method of production of me of these isotopes is proposed. W. E. D.

9.167.3 = 3 2234

On some new fission products of uranium (ruthenium, odium and silver). SEELMANN-EGGEBERT, W. *Naturwiss.*, **33**, 279–80 (*Nov.* 15, 1946) *In German.*—A Ru otope of 1 yr period, which yields a 40-sec Rh leading a stable isotope of Pd, has been separated from the ssion products. Two Ag isotopes, of 20 min and 3 min, are also reported. A. P. F.

9.167.3 : 545.1 = 3 2235

Separation and enrichment of the artificially radioactive odium isotope $^{24}_{11}Na$. DREHMANN, U. *Naturwiss.*, **33**, 4 (*July* 15, 1946) *In German.*—"Schering" analytical gO is a suitable starting substance for the separation $^{24}_{11}Na^{24}$ obtained from $_{12}Mg^{24}$ by a (n, p) process. y boiling with $H_2O > 90\%$ of the Na can be separated. urther concn of the Na can be achieved by precipitating e Mg by the Schaffgott method. A. J. M.

39.167.3 : 545.1 = 3 2236

Separation of radioactive strontium in unweighable uantities. GERHARDT, L. *Naturwiss.*, **33**, 24–5 (*July* 15, 946) *In German.*—The chemical separation of Sr esulting from U fission is described. A. J. M.

39.172 : 537.534.74 *see Abstr.* 2171

39.172 : 537.591.1 *see Abstr.* 2175

39.172 : 539.18. 2237

Processes involving charged mesons. LATTES, C. M. G., MUIRHEAD, H., OCCHIALINI, G. P. S., AND POWELL, C. F. *Nature, Lond.*, **159**, 694–7 (*May* 24, 1947).—Two examples ave been found, in photographic emulsions exposed at igh altitudes, of mesons which produce secondary nesons at the end of their range. Both secondary mesons vere ejected with nearly equal energy, and the suggestion s made that they represent mesons of 60 m_e less mass han the primary. Several examples were also found of ransmutations involving the ejection of slow mesons. The uncertainties involved in meson mass estimation by he grain-counting methods [Abstr. 984 (1947)] are iscussed, and an alternative, based on the total energy elease observed in a disintegration, is investigated; one uch gives a minimum value of 240 m_e.

39.172.1 : 539.166 2238

Gamma-ray yield curve of aluminum bombarded with rotons. BROSTRÖM, K. J., HUUS, T., AND TANGEN, R. *Phys. Rev.*, **71**, 661–6 (*May* 15, 1947).—The proton energy ange 0·5–1·4 MeV was investigated, with a resolution f 4 keV. Several previously known peaks were re-olved into groups of narrow lines which are given in iagrams and tables. The proton width was estimated t <1 keV, and a rough estimate of the γ-ray counter fficiency gave a radiation width of ~1 eV. A.

39.172.3 : 537.531.8 2239

Range-momentum measurements of particles emitted in uclear disintegrations induced by 100-Mev X-rays. KLAIBER, G. S., LUEBKE, E. A., AND BALDWIN, G. C. *Phys. Rev.*, **71**, 649–56 (*May* 15, 1947).—The X-rays bombarded the glass wall of a cloud chamber containing a series of Al foils, and submitted to a magnetic field of 2 650 gauss. Out of ~200 tracks of heavily ionizing particles observed, the ranges of 102 were measured; the majority could be definitely identified as protons, all showed positive curvature, and none was caused by particles of ~ meson mass. Several particles had energies >28 MeV. A.

539.172.4 2240

Evidence for an (n, α) reaction induced in O^{17} by thermal neutrons. MAY, A. N., AND HINCKS, E. P. *Canad. J. Res. A*, **25**, 77–87 (*March*, 1947).—It can be shown that the reaction O^{17} (n, α) C^{14} should be exothermic by 1·72 MeV. An investigation was made of the pulse spectrum produced when an ionization chamber containing O was placed in a flux of thermal neutrons. Two O samples were compared, one being enriched (3× normal), and the other impoverished (½ normal), in O^{17}. Differences between these two showed a considerable number of pulses between 1 and 2 MeV, with a maximum at 1·4 MeV. Reasons are given for assigning these pulses to the above reaction, and a value of $(0{\cdot}46 \pm 0{\cdot}11) \times 10^{-24}$ cm² for the cross-section was deduced of the pure isotope O^{17}. The effect measured is about 20% of the total thermal neutral capture cross-section reported for ordinary oxygen. A.

539.172.4 2241

Ternary and quaternary fission of uranium nuclei. TSIEN, S.-T., HO, Z.-W., VIGNERON, L., AND CHASTEL, R. *Nature, Lond.*, **159**, 773–4 (*June* 7, 1947).—Earlier reports [Abstr. 1629 (1947)] are summarized and slightly corrected. A case of tripartition with fragment masses ~127, 77 and 32 is reported.

539.172.4 = 4 2242

On the mechanism of ternary fission in uranium. TSIEN, S.-T. *C.R. Acad. Sci., Paris*, **224**, 1056–8 (*April* 9, 1947) *In French.*—The direction of emission of a light particle as a third partner in fission is calculated in terms of the liquid drop model and shown to agree with measurements on photographic plate tracks. A. P. F.

539.172.4 = 4 2243

Range in aluminium and stopping power of gold for a given fission fragment from uranium. SUZOR, F. *C.R. Acad. Sci., Paris*, **224**, 1155–6 (*April* 21, 1947) *In French.*—Fission fragments were allowed to traverse a succession of Al foils. The activities in the individual foils due to collection of a single species of fragment were measured after a chemical separation; from the data, the number/range curve could be obtained. The straggling of range is much greater than Bohr's theory would predict, implying a wide spread in the initial energy of a fragment of given Z. By repeating the experiments with an Au foil of known thickness between the U layer and the Al foils, the mass stopping power of Au relative to Al was found to be 0·350. A. P. F.

539.174 : 539.163.2 *see Abstr.* 2226

539.18 2244

Proposed methods of detecting the neutrino. WANG, K. C. *Phys. Rev.*, **71**, 645–6 (*May* 1, 1947).

539.18 : 539.165.2 2245

The mass of the neutrino. FRANK, F. C. *Proc. Phys. Soc., Lond.*, **59**, 408–12 (*May*, 1947).—From a collation of the energies involved in nuclear reactions and radioactive decays, which together represent closed cycles, it is shown that the rest-mass of the neutrino, m_ν, is beyond any reasonable doubt less than that of the electron, m_e,

and probably less than $m_e/10$. It cannot be shown with certainty to be measurably distinct from zero. A.

539.18 : 539.172 *see Abstr.* 2237

539.185 2246

On the theory of the diffusion and the slowing down of neutrons. I. The diffusion of neutrons of constant energy in an infinite medium. WALLER, I. *Ark. Mat. Astr. Fys.*, **34 A** (*No.* 1) *Paper* 3, 9 *pp.* (1947).—The space distribution of neutrons is calculated for the case of anisotropic scattering, assuming a point source of constant strength which emits neutrons isotropically. A. P. F.

539.185 2247

On the theory of the diffusion and slowing down of neutrons. II. The energy distribution of neutrons slowed down by elastic impacts. WALLER, I. *Ark. Mat. Astr. Fys.*, **34 A** (*No.* 1) *Paper* 4, 9 *pp.* (1947).—A solution is obtained for the case of a medium containing several kinds of atoms, and in which absorption and elastic scattering (isotropic in the C.G.) take place. A. P. F.

539.185 2248

On the theory of the diffusion and the slowing down of neutrons. III. The space energy distribution of neutrons in a moderator. WALLER, I. *Ark. Mat. Astr. Fys.*, **34 A** (*No.* 1) *Paper* 5, 11 *pp.* (1947).—A formula is derived which approximates to a Gaussian error function for neutrons that have been considerably slowed down since birth. Isotropy of scattering in the C.G. system is assumed. Agreement with experiment is only approximate. A. P. F.

539.185 2249

On the stationary energy and spatial distribution of neutrons in a medium of infinite size. ERIKSSON, H. A. *Ark. Mat. Astr. Fys.*, **34 B** (*No.* 1) *Paper* 2, 8 *pp.* (1947).—Approximations are employed to obtain simple formulae for the distribution around a point source of monochromatic neutrons in graphite. A. P. F.

539.185 2250

Interference phenomena of slow neutrons. FERMI, E., AND MARSHALL, L. *Phys. Rev.*, **71**, 666–77 (*May* 15, 1947).—The following experiments have been performed to determine the phase of the scattered with respect to the primary neutron wave. Theoretically this phase change is very close to either 0° or 180°. (*a*) Measurement of the intensities of Bragg reflection of various orders of many crystals, and comparison with the theoretical values of the form factor. (*b*) Total scattering cross-section of gas molecules for wavelengths long compared with the molecular dimensions. (*c*) Determination of the limiting angles for total reflection of neutrons on various mirrors. Ba, Be, C, Ca, Cu, F, Fe, Mg, N, Ni, O, Pb, S and Zn scatter with 180°, Li and probably Mn with zero, phase difference. I, Br, Cl, K and Na behave alike (probably 180°). Coherent scattering cross-sections have been determined for several elements. A.

539.185 2251

Neutron scattering in ortho- and parahydrogen. HAMERMESH, M., AND SCHWINGER, J. *Phys. Rev.*, **71**, 678–80 (*May* 15, 1947).—The cross-section for the scattering of cold neutrons by parahydrogen is sensitive to the range of the forces in the triplet state. To facilitate the determination of the range from such measurements, expressions have been obtained for the dependence of the ortho and para cross-sections on neutron energy and hydrogen temperature. The interpretation of transmission measurements is complicated by the existence of radiative capture, which is comparable in importance to scattering in parahydrogen. The different energy-dependence of the two processes should permit an accurate determination of the individual cross-sections. A.

539.185 2252

Scattering of neutrons of energy between 12 Mev and 13 Mev by protons. LAUGHLIN, J. S., AND KRUGER, P. G. *Phys. Rev.*, **71**, 736 (*May* 15, 1947).—The angular distribution of the recoil protons is consistent with a spherically symmetrical scattering or a slight asymmetry, in a sense opposite to that found by Amaldi and his colleagues [*Naturwiss.*, **30**, 582 (1942)] and by Champion and Powell [Abstr. 2617 (1944)]. W. E. D.

539.185 2253

Diffraction of neutrons by a single crystal. ZINN, W. H. *Phys. Rev.*, **71**, 752–7 (*June* 1, 1947).—The intensity of neutrons emitted by the nuclear chain reactor has been shown to be sufficiently great to permit the observation of the Bragg reflection of neutrons by a single crystal. A single crystal monochromator has been constructed and used for the investigation of resonances. The well-known resonance in Cd has been measured and the Breit–Wigner constants determined. A.

539.185 : 517.948.3 2254

The variational method for asymptotic neutron densities. MARSHAK, R. E. *Phys. Rev.*, **71**, 688–93 (*May* 15, 1947).—It is shown how to obtain quite accurate values of the asymptotic neutron density in the following cases: (*a*) Milne's problem for the plane, (*b*) infinite scattering medium surrounding black spherical core, (*c*) infinite scattering medium surrounding black spherical core with air gap. A.

539.185.7 2255

The ratio of the capture cross-sections of lithium and boron for thermal neutrons. FENNING, F. W., GRAHAM, G. A. R., AND SELIGMAN, H. *Canad. J. Res. A*, **25**, 73–6 (*March*, 1947).—A small BF_3 chamber was used to obtain the spatial distribution and density integrals of thermal neutrons produced by a source in aqueous solutions of compounds of Li and B. The effects of the finite size of the chamber were minimized by adjusting the concentrations of the solutions so that the mean life of thermal neutrons was the same in both. The scattering mean free paths are also almost identical. The final result is $\sigma_{Li}/\sigma_B = 0{\cdot}0948 \pm 0{\cdot}0013$. Taking $\sigma_B = 705 \times 10^{-24}$ cm², $\sigma_{Li} = (66{\cdot}8 \pm 1{\cdot}0) \times 10^{-24}$ cm². A.

539.185.7 2256

Measurement of neutron cross sections with a crystal spectrometer. STURM, W. J. *Phys. Rev.*, **71**, 757–76 (*June* 1, 1947).—By use of the mono-energetic beams of neutrons diffracted from the (100) planes of LiF [Abstr. 2253 (1947)], survey measurements have been made of the total neutron cross-section of a series of elements, including several strongly absorbing rare earths, and elements commonly used as neutron filters and detectors, between 0·04 and 65·0 eV. The method permits energy-dependent cross-section measurement by activation or by transmission. However, all values reported were obtained by calculation from observed transmission data, because the range of available intensities in the diffracted beam was best measured with a B counter. Correction methods for resolution and order effects have been developed which are valid for low neutron energies. The following absorption levels have been observed: Rh, 1·28; Au, 5·4; Ir, 0·635, 1·35, and 6·0; Gd, 0·031; Sm, 0·096, 10·0, and 33·0; Eu, 0·465, 3·3, 9·2, and 22·0 eV. Resonance levels at energies < 0 were found in Dy at $-1{\cdot}01$ and in Eu at $-0{\cdot}011$ eV. A.

539.185.7 : 539.132 = 4 *see Abstr.* 2194

539.185.7 : 539.152.1 2257

Resonance phenomena in the elastic scattering of photo-neutrons with energies of 0·1, 0·2, 0·3 and 0·4 MeV by atomic nuclei. GOLOBORODKO, T. *J. Phys., USSR*, **11**

. 1) 44–8 (1947).—Regular variations of cross-section
n energy, consisting of maxima and minima separated
~100 keV, were found for both light and heavy
ents, which are hard to understand if the energy levels
the nucleus get closer together as atomic number
eases. The suggestion is advanced that all nuclei have
same surface structure, made up of α-particles. A.

.185.7 : 539.155.2 2258

**he neutron absorbing isotopes in gadolinium and
arium.** LAPP, R. E., VANHORN, J. R., AND DEMPSTER,
J. *Phys. Rev.*, **71**, 745–7 (*June* 1, 1947).—The large
orption for slow neutrons in Sm was found to be
sed by isotope 149, and in Gd by isotopes 155 and
, the cross-section for 157 being about 3× that for
. Mass spectra were made with a double-focusing
s spectrograph, using a spark with Ni tubes packed
n oxide as electrodes. Mass spectra of normal
ples were compared photometrically with those of
ples in which this isotope abundance had been
ed by long exposure to slow neutrons. In the altered
the abundance of mass 157 was < instead of > 155,
156 became > rather than < 160. In Sm the
ndance of mass 149 was reduced to be nearly as weak
148, and mass 150 was correspondingly increased. A.

STRUCTURE OF SOLIDS 539.2

.215.4 : 531.754.2 2259

article size analysis. HEYWOOD, H. *Nature, Lond.*,
, 717–18 (*May* 24, 1947).—A report of a conference,
). 4, 1947. The different methods of analysis, and the
portance of their correlation, were discussed; definition
terms, particularly with reference to aggregates of
ticles, is important.

.23 : 537.533.74 2260

**he interpretation of electron diffraction patterns from
rocarbon films.** KARLE, J., AND BROCKWAY, L. O.
Chem. Phys., **15**, 213–25 (*May*, 1947).—Theoretical
ressions previously derived [Abstr. 2899 (1946)] have
n extended and applied to the calculation of character-
c diffraction patterns, to form a basis for obtaining
ormation about the molecular orientation. For the
g chain molecules, the azimuthal direction, and the
lination from the vertical may be determined in-
endently. The orientation of the hydrocarbon chain
ut its own axis is less easily established, since it is
ermined only from the intensity distribution within
separate diffraction orders. When the declination is
iciently large, randomness in the azimuthal directions
distinguished by the crossed-line pattern obtained.
ndomness in the declination from the vertical may be
mated from the irregular spacing of the intercepts of
crossed lines. Quantitative intensity data would
mit a more precise study of the angular distribution
the declination, and also of the orientation of the
rocarbon chain about its own axis. A.

.23 : 621.317.4 : 538.22.08 = 4 *see Abstr.* 2180

.234 : 537.311.31 *see Abstr.* 2147

.27 : 537.533.73 : 621.385.833 = 4 2261

lectron diffraction and its applications. TRILLAT, J. J.
perientia, **3** (*No.* 3) 85–95 (1947) *In French.*—A survey
he application of electron diffraction for the general
der. Considers applications to the structure of thin
s, metallic deposits, surface oxidation, polishing and
rication. An account is also given of the use of
tron diffraction in the study of photographic processes
l in investigating the structure of free molecules as in
as. J. T.

ELASTICITY . STRENGTH . RHEOLOGY 539.3/.8

539.31 : 548.0 2262

Finite elastic strain of cubic crystals. BIRCH, F. *Phys. Rev.*, **71**, 809–24 (*June* 1, 1947).—Murnaghan's theory of finite strain is developed for a medium of cubic symmetry subjected to finite hydrostatic compression, plus an arbitrary homogeneous infinitesimal strain. The free energy is developed for cubic symmetry to include terms of the 3rd order in the strain components. The effect of pressure upon the 2nd-order elastic constants is found and compared with experiment, with particular reference to the compressibility; the pressure-volume relation in several approximations is compared with the measurements to 100 000 kg/cm². The simplest approximation is shown to give a satisfactory account of most of the experimental data. The results are also compared with some of the calculations based on Born's lattice theory. A.

539.32 2263

Elastic losses in some high polymers as a function of frequency and temperature. SACK, H. S., MOTZ, J., RAUB, H. L., AND WORK, R. N. *J. Appl. Phys.*, **18**, 450–6 (*May*, 1947).—Three methods were used, in which the motion of a reed in free or forced vibration was observed. Natural rubber at temperatures above 20°c, and polyvinyl chloride exhibit frequency-independent losses, the mechanism of which is not yet clear. The results for rubber below 20° and for GRS can be explained by a relaxation theory. The behaviour of the elastic losses also reflects the existence of a second-order transition, below which rotation of chain segments is hampered. A.

539.32 2264

Elastic properties of cork. II. Stress-temperature relationship of compressed cork. DART, S. L., AND GUTH, E. *J. Appl. Phys.*, **18**, 470–4 (*May*, 1947).—See I, Abstr. 2369 (1946). After the sample had relaxed at constant temp. and compression for a time sufficiently long so that the change of stress with time could be neglected, stress-temp. curves were obtained, which showed a linear dependence of the stress upon the temp., and from them the resolution of the stress into its additive components due to internal energy and entropy was carried out. The physical significance of this resolution is discussed. A.

539.32 2265

Elastic properties of cork. III. Hydrostatic and ordinary load-compression curves for cork. DART, S. L., ROBINSON, H. A., AND GUTH, E. *J. Appl. Phys.*, **18**, 474–8 (*May*, 1947).—Load-compression curves were taken for natural cork. The *S*-shape of the curves is discussed, and a theoretical fit is made for the high end of the curve, assuming an initial stiffness and an incompressible part of the cork material. A comparison is made between repeated compressions, with and without a recovery period of time. Pressure-volume curves were also taken and their significance discussed in connection with the load-compression curves leading to an evaluation of Poisson's ratio. A.

539.32 : 534.131 2266

Sonic determination of the elastic properties of ice. NORTHWOOD, T. D. *Canad. J. Res. A*, **25**, 88–95 (*March*, 1947).—By measuring the velocity of various types of elastic waves in a solid it is possible to deduce Young's modulus and Poisson's ratio. Longitudinal, extensional, and Rayleigh wave velocities were measured in ice, the first by resonance in a rod and the other two by a pulsing technique. The value obtained for Young's modulus was $9{\cdot}8\times10^{10}$ dynes/cm² and for Poisson's ratio 0·33. A.

539.32 : 534.321.9 : 548.0 : 534.22 *see Abstr.* 2070

539.32 : 548.0 2267

Elastic constants of alums and mixed alums. SUNDARA RAO, R. V. G. *Curr. Sci.*, **16**, 91–2 (*March*, 1947).—Values determined by the sound-velocity method [Abstr. 2565 (1945)] are reported.

539.32.082.4 : 534.614 : 620.172.225 : 679.5 2268

Acoustic determination of the physical constants of rubber-like materials. NOLLE, A. W. *J. Acoust. Soc. Amer.*, **19**, 194–201 (*Jan.*, 1947).—The necessary relations for computing Young's modulus and the associated viscosity coeff. from acoustic data are given. An experimental method is described for measuring the sound phase velocity and attenuation of longitudinal waves in thin narrow samples from 1–26 kc/s. A vibration generator excites one end of a sample held under small tension, while a receiving element moves along the strip. The r.m.s. error in attenuation measurements is 6–12%, and in velocity 2–9%. Sample data and elastic and viscous coefficients are given for a carbon-black buna-N cement. A.

539.37 : 548.24 *see Abstr.* 2319

539.374 2269

Plastic flow, creep, and stress relaxation. I. Plastic flow. MACK, C. *J. Appl. Phys.*, **17**, 1086–92 (*Dec.*, 1946).—Plastic substances are considered to be composed of units of flow with various yield values. It is shown that in this case the product of the strain rate and viscosity is equal to the sum of the differences between the applied stress and the yield values. This relationship can be applied to any plastic system free of elastic after-effect and expresses its mechanical properties in terms of a coefficient of viscosity which is independent of the stress applied. With the proper choice of the distribution of yield values any kind of relation between stress and strain rate can be established. A.

539.374 : 531.259.1 *see Abstr.* 2037

539.374 : 539.434 2270

Plastic flow, creep, and stress relaxation. II. Creep. MACK, C. *J. Appl. Phys.*, **17**, 1093–1100 (*Dec.*, 1946).—The general equation covering the deformation of plastic substances given in Part I is applied to creep. Creep is defined as a mechanism of deformation for systems which have a curvilinear relationship between stress and strain rate and a curvilinear relationship between strain and time at constant stress. Equations are derived which give the stress as a function of strain rate and time (time-hardening), as a function of strain rate and strain (strain-hardening) and as a function of strain rate, strain, and time. The relaxation of stress at constant strain is discussed, and it is shown that the stress relaxation depends upon the history of the substance under test. The concept of creep is also applied to thixotropic systems which are considered as cases of work-softening. A.

539.374 : 539.389.4 2271

Plastic flow, creep, and stress relaxation. III. Creep and elastic after-effect. MACK, C. *J. Appl. Phys.*, **17**, 1101–7 (*Dec.*, 1946).—A large number of substances show the phenomenon of elastic after-effect, and part of their deformation recovers on unloading as a function of time. This portion of the deformation at constant stress has a strain rate which decreases with time and is therefore comparable to creep. Expressions are given for the strain-time relationships of such systems, and the process of stress relaxation at constant strain is discussed. The equations are applied to data given in the literature, and it is shown that they describe the deformation an relaxation mechanisms of a variety of materials.

539.374 : 532.542.1 227

A kinetic energy correction for the flow of plastic liqui through circular pipes. LOMER, T. R. *Phil. Mag.*, 3 571–4 (*Aug.*, 1946).—If P is the total pressure differenc across the ends of the tube, p the pressure used in ove coming plastic resistance, W the kinetic energy imparte per sec to the liquid, and V the volume flowing per s through the tube, then $pV = PV - W$. Thus W/V is th correction term to be subtracted from the applie pressure, and an expression for W/V is obtained on th basis of Scott-Blair's recent formula for the rate flow. L. S.

539.385 22

Torsion of a rubber cylinder. RIVLIN, R. S. *J. Ap Phys.*, **18**, 444–9 (*May*, 1947).—It has been predict theoretically that, in general, a right-circular cylinder incompressible, highly elastic material, which is isotrop in its underformed state, cannot be held in a state of pu torsional deformation by means of a torsional coup alone. In addition, normal surface tractions must exerted over the plane ends of the cylinder. Experimen are reported in which this phenomenon is observed pure gum compound. The dependence of the surfa traction on amount of torsion and its distribution ov the surface of the cylinder is studied by measuring t bulging of the rubber into small holes in a metal pla on one end of the cylinder.

539.389.4 : 539.374 *see Abstr.* 2271

539.4 : 548.7 22

Dislocations in a simple cubic lattice. NABARR F. R. N. *Proc. Phys. Soc., Lond.*, **59**, 256–72 (*Marc* 1947).—The properties of dislocations are calculated an approximate method due to Peierls [Abstr. 6 (1940)]. The shear stress required to move a dislocatio in an otherwise perfect lattice $\simeq$ a thousandth of t "theoretical" shear strength. A pair of dislocations opposite sign in the same glide plane cannot be in stab equilibrium unless they are separated by a distance of t order of 10 000 lattice spacings. If an external she stress is applied there is a critical separation of the pa of dislocations at which they are in unstable equilibriu The energy of this unstable state is the activation ener for the formation of a pair of dislocations. It depends the external shear, and for practical stresses $\simeq$ 7 eV p atomic plane.

539.4.011.22 22

A new criterion of yielding in metals. SWAINGER, K. *Nature, Lond.*, **159**, 741–2 (*May* 31, 1947).—It is shov that a linear relation between the simple tensile yield str S_0, and the vector stresses **T** and **S** satisfies the expe mental results of Taylor [Abstr. 843 B (1932)]. It based on the relation $T_0/S_0 = 1/(1+q)\sqrt{2} = 0{\cdot}56$, whe T_0 is the simple shear yield stress and q = Poisso ratio = 0·26, which agrees with experimental valu [See Abstr. 1704 (1946)].

539.4.011.25 22

An analysis of the conditions for rupture due to Griffi cracks. ELLIOTT, H. A. *Proc. Phys. Soc., Lond.*, 5 208–23 (*March*, 1947).—Griffith's theory is extended b more detailed consideration of the interatomic forc resisting the spread of a crack in a crystalline isotro substance (e.g. a metal). A model is taken of two semi- blocks attracting each other with a force $f(z)$ per u area, when at a distance $z + a$ from each other. T conditions of unstable equilibrium are found. Possib physical models are discussed.

).4.011.25 : 620.191.33 2277
The speed of propagation of brittle cracks in steel. IDSON, G., AND GREENFIELD, M. *J. Appl. Phys.*, **18**, 5–7 (*April*, 1947).—Brittle failure was produced in ıched steel tensile specimens. The measured speed of ›pagation was ~ 40 400 in/sec. A.

).4.016.2 : 538.221 *see Abstr.* 2182

).4.019.1 2278
Delayed fracture in glass. GURNEY, C. *Proc. Phys. Soc., nd.*, **59**, 169–85 (*March*, 1947).—The mechanism of the ect observed in mineral glass [Abstr. 1708 (1946)] is cussed, and it is found necessary to modify Griffith's orem of the rate of spread of cracks. Glass cannot be sidered to be in phase equilibrium when stress-free, d stress-accelerated phase changes at the base of cracks uld be expected to cause an appreciable delayed cture effect. Other causes discussed are evaporation important), and accelerated atmospheric attack at the of the crack. Included in the paper are formulae for stress coefficients of vapour pressure, entropy and ase-transition temp., of material subjected to a neralized stress system. A.

9.42 2279
The effect of temperature on the strength and fatigue glass rods. VONNEGUT, B., AND GLATHART, J. L. *Appl. Phys.*, **17**, 1082–5 (*Dec.*, 1946).—By the use of an ctrodynamic quick-loading device, the strength of atched soda-lime glass rods was measured at various mperatures between −190°C and 520°C for load rations of 0·1, 10, and 100 sec. The strength was ghest at the lowest temperature, declined to a min. at 0°–200°C, and then increased for higher temperatures. atic fatigue was exhibited at all temperatures, being aximum in the region of minimum strength. Comrisons with the results of other experimenters are ade. A.

9.431.4 2280
Damping capacity, strain hardening and fatigue. ANSTOCK, R. F. *Proc. Phys. Soc., Lond.*, **59**, 275–87 *March*, 1947).—An electromagnetic method of exciting rsional resonance vibrations is described. For some loys of Al, vibrational strains of sufficient magnitude to cause fatigue cracks can be developed by this method at ~ 1 kc/s. During vibration, measurements are made of the damping capacity. Fatigue failure of two binary alloys containing Mg is shown to be preceded by strain hardening. The endurance of individual specimens is related to the amount of irreversible strain imposed per cycle, failure occurring when the cumulative internal strain approaches a limiting value. A.

539.434 : 539.374 *see Abstr.* 2270

539.53 = 3 2281
Abrasive strength and boundary surface energy of hard materials. V. ENGELHARDT, W. *Naturwiss.*, **33**, 195–203 (*Oct.* 15, 1946) *In German.*—Following a general review of the subject, details are given of investigations of the abrasive mechanism with various hard substances in several solutions and pure liquids, which lead to suggestions on the interaction between the hard surfaces and the molecules of the lubricating liquid, and on the nature of the forces arising from hard bodies. Applications of the work to industrial problems are discussed. G. O. B.

539.62 : 548.7 2282
Internal friction of zinc single crystals. SWIFT, I. H., AND RICHARDSON, J. E. *J. Appl. Phys.*, **18**, 417–25 (*April*, 1947).—The decrement, Δ, of single crystal rods vibrating longitudinally at 45 kc/s was measured. At strain amplitudes $< \sim 10^{-5}$ or 10^{-6}, Δ was const., but had values from 7×10^{-5} to $> 2\times10^{-3}$ for different crystals, depending on their history, which also affected the behaviour of Δ at higher amplitudes. It is concluded that Δ is the result of two separate processes, and a qualitative explanation is advanced based on dislocation theory. A.

539.621 2283
The friction of heated sleigh runners on ice. PFALZNER, P. M. *Canad. J. Res. F*, **25**, 192–5 (*March*, 1947).—An attempt was made to reduce the sliding friction of sleigh runners on ice at 20°F, 0°F and −10°F by applying heat to the runners. The efficiency of this method was found to be less than 20%. Some doubt is thrown on the simple theory that the low friction on ice is due to a lubricating film of water. A.

539.893 : 541.126 *see Abstr.* 2287

PHYSICAL CHEMISTRY 541

PHASE EQUILIBRIUM 541.121/.123

41.123.2 : 532.782 = 3 2284
On the equilibrium diagram of the KCl–KBr system. ONTELL, N. *Comment. Phys.-Mat., Helsingf.*, **10** (*No.* 3) 10 *pp.* (1940) *In German.*—A thermodynamic argument is applied to previous measurements of the heat of rmation of KCl–KBr solid solutions [Abstr. 2141 947)]. It suggests that below 400°K there should be a lubility gap, extending at room temperature from 22 .55 mol.% KCl. A. J. C. W.

41.123.3 : 669.715.74.5 2285
The intermetallic compound phases of the system uminium–manganese–zinc. RAYNOR, G. V., AND AKEMAN, D. W. *Proc. Roy. Soc. A*, **190**, 82–101 *une* 17, 1947).

41.123.5 : 539.155.2 2286
Calculation of equilibrium constants for isotopic change reactions. BIGELEISEN, J., AND MAYER, M. G. *Chem. Phys.*, **15**, 261–7 (*May*, 1947).—It is pointed rt that the possibility of chemical separation of isotopes is a quantum effect. This permits a direct calculation of the difference in the free energies of two isotopic molecules. Tables and approximation methods are given which permit a rapid calculation of equilibrium constants if the frequency shifts on isotopic substitution are known. Several applications are discussed. A.

REACTION KINETICS 541.124/.128

541.126 : 539.893 2287
The effect of high mechanical stress on certain solid explosives. BRIDGMAN, P. W. *J. Chem. Phys.*, **15**, 311–13 (*May*, 1947).—Eleven different solid explosives have been subjected at room temperature to stresses of the order of those which prevail in the detonating front. Several survived without detonation. It is probable that in those cases where detonation occurred secondary effects were responsible, such as striking of sparks by fractured fragments of steel. The general conclusion is that stresses of these magnitudes, without the co-operation of high temperature, cannot be counted on to produce detonation. Values were obtained for the plastic flow stress as a

function of hydrostatic pressure. The strength increases approximately linearly with pressure. A.

541.127.1 : 542.952.6 2288

Determination of the velocity coefficients for polymerization processes. I. The direct photopolymerization of vinyl acetate. II. The photosensitized polymerization of vinyl acetate by benzoyl peroxide. III. Effect of environment on polymerization processes. BURNETT, G. M., AND MELVILLE, H. W. *Proc. Roy. Soc. A*, **189**, 456–507 (*June* 3, 1947).

541.127.1.08 : 534.321.9 = 82 2289

Application of supersonic oscillations to the observation of physical-chemical processes. SOKOLOV, S. J. *J. Tech. Phys., USSR*, **16** (*No.* 7) 783–90 (1946) *In Russian.*—An experimental method is suggested for measurements of speeds of chemical reactions in solid, liquid and gaseous media in the range of μsec to hours. The propagation velocity of supersonic waves and their absorption coefficient are measured continuously in the medium investigated and thus serve as indicators. A. L.

ELECTROCHEMISTRY 541.13

541.132 = 4 2290

On the nature of hydrogen ions in electrolytic solutions. DARMOIS, E., AND SUTRA, G. *C.R. Acad. Sci., Paris*, **222**, 1286–8 (*May* 27, 1946) *In French.*—Various models for the H^+ ion are discussed and the values of their mobility and temperature coefficient of conductivity are compared with the experimental values. L. S. G.

541.133.1 : 539.155.2 = 3 *see Abstr.* 2212

541.135.4 = 82 2291

Investigation of solid electrolytes for gaseous elements. DAVTIAN, O. K. *Bull. Acad. Sci. URSS, Dep. Sci. Tech.* (*No.* 1) 107–14 (1946) *In Russian.*—Eleven special materials, consisting mainly of Na_2CO_3 with addition of substances like quartz, CaO, WO_3 and Monazite were investigated before and after firing for their suitability as ion conductors. Specific resistances are tabulated and short technological comments on each compound given. A. L.

541.135.4 = 82 2292

A gas cell with a solid electrolyte. DAVTIAN, O. K. *Bull. Acad. Sci. URSS, Dep. Sci. Tech.* (*No.* 2) 215–18 (1946) *In Russian.*—Difficulties of a suitable choice of solid electrolyte, which must not be an electronic- or mixed ion-electronic conductor, are discussed, and a novel construction is described, using electrodes with air and CO layers and mountings of ferromagnetic nature as carriers. The solid electrolyte disc consists of a mixture of Na_2CO_3, pre-fired Monazite, WO_3 and special glass. The preparation of this mixture is described, and its properties are discussed in tables and by curves. A drawing of the whole element assembly is also included. A. L.

541.135.5 : 537.226 : 620.197.6 2293

Electrical properties of paint films on metals. WORMWELL, F., AND BRASHER, D. M. *Nature, Lond.*, **159**, 678–9 (*May* 17, 1947).—The resistance and capacitance of the films, immersed in sea water, remained constant for a period (30 days) and then respectively fell and rose rapidly, simultaneously with the onset of rusting. The potential of the plates showed simultaneous less marked changes.

ADSORPTION 541.183

541.183.36 2294

The adsorption of vapours on mercury. III. Polar substances. KEMBALL, C. *Proc. Roy. Soc. A*, **190**, 117–37 (*June* 17, 1947).—[See Abstr. 445–6 (1947)]. Wat acetone and the normal alcohols from methyl to he gave reversible adsorption and, with the exception water, gaseous films were formed at low pressur Methyl and ethyl alcohols showed the adsorption of second layer at higher pressures, the double layer havi half the co-area of the original monolayer. Acetone ga rise to a double layer and finally a triple layer (with or third of the original co-area). The property of multilay formation was thought to be one of small partially pol molecules. For the gaseous films of *n*-butyl, *n*-amyl a *n*-hexyl alcohols the co-areas and the thermodynam data indicated that the molecules were lying flat on t surface. These three substances showed two-dimensior condensation to liquid films at higher pressures.

541.183.36 : 532.613.5 *see Abstr.* 2050

541.183.584 = 3 22

Adsorption of artificially radioactive cadmium ions silver chloride. JACOBI, E. *Helv. Phys. Acta*, **20** (*No.* 166–72 (1947) *In German.*—The adsorption *x* increas as the negative charge due to adsorbed Cl^- increas In presence of *y*N HNO_3, *x* decreases owing to coagulati of the AgCl if $y > 0{\cdot}25$, and increases due to diminish solubility of $CdCl_2$ if $y < 0{\cdot}25$. S. J.

541.23 : 539.155.2 = 3 *see Abstr.* 2213

541.23 : 548.73 22

Atomic mass of silicon. BATUECAS, J. *Nature, Lon* **159**, 705 (*May* 24, 1947).—The value 28·075 is given comparing the molecular mass of silica with that calcite, and of rock salt, the comparison being based X-ray determinations of unit cell contents and dimensior

541.24 : 541.64 : 534.614 22

A sound velocity method for determination of molecul weight of liquid polymers. WEISSLER, A., FITZGERAL J. W., AND RESNICK, I. *J. Appl. Phys.*, **18**, 434 (*May*, 1947).—The number average molecular weig $M = Bd/\{v^{\frac{1}{3}} - A(n^2 - 1)/(n^2 + 2)\}$, v = sound velocit d = density, n = refractive index and A and B are tv empirical constants. Accuracy of about 2% was attain for the lower polyethylene glycols. The method seer suitable for molecular weights up to several thousan Sound velocities were measured by an acoustic interfer meter, at 1 Mc/s.

CHEMICAL STRUCTURE 541.4/.6

541.553 = 4 22

The theory of directed valencies. GARNIR, H., AN TOUSSAINT, J. *Bull. Acad. Belge, Cl. Sci.* (*Sér.* 5) (*Nos.* 10–11) 508–16 (1946) *In French.*—In this math matical paper, it is shown that the theory of grou affords an alternative method to that of matrices intr duced by Pauling (*Nature of the Chemical Bond*, 193 The argument employed is based on the conception of t atom point nucleus at the centre of a regular polygon polyhedron with *n* vertices, in which *n* electrons a situated so that the resultant electronic atmosphe possesses the symmetry of the regular figure. H. H. H

541.57 22

Remarks on the strengths of bonds. WALSH, A. I *Trans. Faraday Soc.*, **43**, 60–77 (*Jan.–Feb.*, 1947).— survey of various classes of bonds suggests the importan of polarity changes as one factor determining changes length and strength. For a given bond (other thin being equal), the force constant and energy decrease ar the length increases with increasing polarity. Certa explanations of length and strength changes in terms customary resonance theory are therefore unsatisfactor

e strengthening observed in a C–X bond when the C
ms part of a multiple bond occurs also when X is
trogen and therefore, with the halogens, is not an
ct attributable solely to resonance involving the lone
r $p\pi$ electrons. Instead it is probably due in part to
nges in orbital hybridization of the carbon atom. It
ms a general rule that all bonds next to a multiple
nd are stronger than usual, and that all bonds next-
-one to a multiple bond are weaker than usual. A.

.57 2300

A relation between bond order and covalent bond tance. BERNSTEIN, H. J. *J. Chem. Phys.*, **15**, 284–9 ay, 1947).—A relation of the form $R = R_1[2/3 + 1/3 \times - 1)/(n + 1)\}^{p/2}]$ is proposed and tested against the ailable experimental data . A suitable expression for all valent bond distances between atoms of the first row the periodic table of the form $R = Z - A/Z - B[2/3 + (1/3)^{p/2}]$ is also proposed. The agreement between culated and observed values is well within the limits the experimental errors. A.

1.57 2301

Dependence of bond order and of bond energy upon bond gth. GORDY, W. *J. Chem. Phys.*, **15**, 305–10 (*May*, 47).—A simple inverse square relation of the form, $= aR^{-2} + b$ (N = bond order, R = bond length, and b are constants characteristic of any given pair of oms) has been found to agree satisfactorily with the ailable values for bond orders. For CC bonds a and b 6·80 and −1·71; for CN, 6·48 and −2·00; for CO, 5·75 and −1·85, respectively. The available data bond energies E suggest a relation of the same form, $= lR^{-2} + m$. A.

1.57 = 3 2302

Bond energies of fluorine compounds. WICKE, E. *aturwiss.*, **33**, 132–40 (*Sept.* 15, 1946) *In German.*—culiarities in the behaviour of fluorine, as compared th the other halogens, are discussed in relation to the nall radius and high electron density of the fluorine ion d the consequent tendency to form strong chemical nds of predominantly ionic character with easily larisable atoms. L. A. W.

1.57 = 4 2303

Molecular force constants interpreted as a function of larisability. Extension to polyatomic molecules. RIPIAT, J. *Bull. Acad. Belge, Cl. Sci.* (*Sér.* 5) **32** (*Nos.* -9) 465–81 (1946) *In French.*—A general law is established at the force constant f which determines the fundamental harmonic vibrations of two atoms or radicals –Y of a monovalent chemical bond has an intimate lationship with the polarizabilities of these atoms or dicals given by the expression: $f = A + B_1/\alpha_1 + B_2/\alpha_2$ = resultant quantum term of the exchange forces, B_1, B_2 = deformation terms corresponding to the olarizabilities of the two atoms or radicals). In an omologous series when either X or Y remains the same, en one of the terms B/α remains constant, and the law kes the form $f = A + B/\alpha$; resistance to deformation f an intervalency angle obeys this law. H. H. HO.

41.57 : 539.13 2304

Strain in non-tetrahedral carbon atoms. COULSON, A., AND MOFFITT, W. E. *J. Chem. Phys.*, **15**, 151–2 *March*, 1947).—The results of new calculations are eported, which differ from earlier ones [Abstr. 2983–4 1946)] but agree with experimental observations of the HCH angle of cyclopropane (113°).

41.57 : 539.132 *see Abstr.* 2195–6

41.57 : 548.736.42 *see Abstr.* 2328

41.64 : 534.614 : 541.24 *see Abstr.* 2297

CHEMICAL PROCESSES 542.9

542.936 2305

The dehydration of ammonium, potassium and some mixed alums. ACOCK, G. P., GARNER, W. E., MILSTED, J., AND WILLAVOYS, H. J. *Proc. Roy. Soc. A*, **189**, 508–27 (*June* 3, 1947).

542.952.6 : 541.127.1 *see Abstr.* 2288

CHEMICAL ANALYSIS 543/545

543.812 2306

The infra-red direct reading moisture tester. BROCK, R. B. *Chem. and Ind.*, 299–302 (*May* 31, 1947). —The sample is continuously weighed in a special balance during irradiation with i.r. In most cases, the moisture is driven off in 4–8 min without greatly increasing the temp. of the material, and fairly thick samples may be used. A full description of the instrument is given, errors discussed and sample readings with various materials tabulated.

544.4 : 621.317.39 : 614.71 *see Abstr.* 2358

544.64 : 548.737 *see Abstr.* 2334

545.1 : 539.167.3 = 3 *see Abstr.* 2235–6

545.373 2307

A new polarograph. SCHULMAN, J. H., BATTEY, H. B., AND JELATIS, D. G. *Rev. Sci. Instrum.*, **18**, 226–31 (*April*, 1947).—The instrument has a higher permitted speed of operation due to the use of an undamped current recording system which increases sensitivity by ~25%. A.

545.82 : 535.33/.34 2308

Recent developments in industrial emission and absorption spectroscopy. *J. Sci. Instrum.*, **23**, 292–302 (*Dec.*, 1946).—Summarized proceedings of a conference, London, 1946, held by the Institute of Physics. Recent developments described included: The Luft infra-red absorptiometer for gas analysis, using a condenser-microphone arrangement as detector, in a double-beam absorptiometer with chopped input; cathode-ray presentation of infra-red absorption bands; fast thermistor-bolometers with time-constants of a few milliseconds; fast thermopiles with similar time-constants; recent designs of infra-red spectrometers; stabilized spark circuits; direct reading photo-electric spectrometers; a new film-attachment for spectrographs. A. C. M.

545.822 2309

The spectrochemical analysis of nickel alloys. JAYCOX, E. K. *J. Opt. Soc. Amer.*, **37**, 159–62 (*March*, 1947).

545.822 2310

Spectrochemical analysis of ceramics and other non-metallic materials. JAYCOX, E. K. *J. Opt. Soc. Amer.*, **37**, 162–5 (*March*, 1947).

545.822 2311

Spectrochemical analysis by the copper spark method. FRED, M., NACHTRIEB, N. H., AND TOMKINS, F. S. *J. Opt. Soc. Amer.*, **37**, 279–88 (*April*, 1947).

545.822 2312

A method for micro-spectrography of metals. BRYAN, F. R., AND NAHSTOLL, G. A. *J. Opt. Soc. Amer.*, **37**, 311–16 (*May*, 1947).—Qualitative spectrographic analyses of metallic areas <0·05 mm dia. can be obtained by means of: (1) a device for holding a counter-electrode and the specimen to be analysed; (2) an electronic spark generator; and (3) a medium quartz spectrograph. Minute areas such as inclusions, segregations, crystalline phases, surface contaminations, metallic platings, and the extent of metallic diffusion have been successfully analysed. A.

545.822 : 535.33.03 2313

A study concerning characteristics of the high-voltage a.c. arc. BOETTNER, E. A., AND TUFTS, C. F. *J. Opt. Soc. Amer.*, **37**, 192–8 (*March*, 1947).—The effects of the following factors on the reproducibility of intensity ratios of spectral lines were investigated:—photometry, weight of sample on the electrode, preburn time, exposure time, electrode separation, arc current, inductance, and anion-cation effect. Short-period variation data taken by a direct reading technique employing multiplier photo-tubes are also discussed. A.

545.822 : 535.33.03 2314

A hollow cathode source applicable to spectrographic analysis for the halogens and gases. MCNALLY, J. R., JR., HARRISON, G. R., AND ROWE, E. *J. Opt. Soc. Amer.*, **37**, 93–8 (*Feb.*, 1947).—For F, it was found that certain visible lines are, at present, more sensitive than the theoretical *raies ultimes*. The greatest absolute sensitivity obtained, using a specially designed hollow cathode source, was $\sim 0{\cdot}01$ μg, while the greatest concentrational sensitivity was slightly $<$ one part per million. Cl and S were readily detected in amounts as small as 0·20 a 1·0 μg, respectively, in samples weighing 20 mg.

545.827 23

New method of analysis by mass spectrometry. JOH SEN, S. E. J. *Analyt. Chem.*, **19**, 305–6 (*May* 21, 1947). A new method of mass spectrometric analyses is propos in which the usual pressure measurement of the samp prior to expansion is not necessary. Peak ratios are us throughout, and the method is claimed to be capable general application except in the analysis of tena isometric mixtures.

545.828 : 535.243 23

On the use of rotating step sector in combination wi intermittent light sources in spectrochemical analysis. SCHMIDT, R. *Rec. Trav. Chim. Pays-Bas*, **65**, 825– (*Oct.–Nov.*, 1946).—A slowly rotating step sector may used with an interrupted arc for measuring the relati intensities of spectral lines, provided the speed of t sector exceeds the critical speed for the photograph emulsion used. This conclusion is shown to hold f certain films on which measurements were made in t wavelength region 250–350 mμ. J. W. T.

CRYSTALLOGRAPHY 548

548.0 : 535.66 2317

Color centres in alkali halide crystals. SEITZ, F. *Rev. Mod. Phys.*, **18**, 384–408 (*July*, 1946).—An attempt based on old and new work to identify the colour centres. It is considered that those produced by heating in alkali vapour are different from those produced by X-rays and cathode rays; the former are due to a stoichiometric excess of alkali, the latter (*F* centres) are identified as due to electrons trapped at halogen vacancies—as first suggested by de Boer. The evidence is based on the photo-conductivity behaviour, on energy considerations affecting relative probability of formation of different possible centres and on recent measurements of density changes (1 in 10^4) on coloration by X-rays by Stern, Estermann and Leivo. Some recently discovered bands (*R*) on the long-wave side of the *F* bands are identified as aggregates of *F* centres, and the *M* bands of Mollwo as combinations of *F* centres with a pair of vacancies. J. E.

548.0 : 538.221 *see Abstr.* 2183

548.0 : 539.31 *see Abstr.* 2262

548.0 : 539.32 *see Abstr.* 2267

548.0 : 539.32 : 534.321.9 : 534.22 = 3 *see Abstr.* 2070

548.0 : 549.211 : 535.43 *see Abstr.* 2119

548.12 2318

Partitioning of space into enantiomorphous polyhedra. MELMORE, S. *Phil. Mag.*, **37**, 574–6 (*Aug.*, 1946).—A particular partitioning is described in which the unit cell is constructed from a rhombic dodecahedron by producing the 4 faces, which meet a given face, until they meet in a point. The cell has the symmetry of the space group $R\bar{3}$. L. S. G.

548.24 : 539.37 2319

The mechanism of calcite and nitre twinning under plastic deformation. GARBER, R. *J. Phys., USSR*, **11** (*No.* 1) 55–66 (1947).—The process may be described as a sequence of four distinct stages: (1) Elastic deformation of the single crystal. (2) Formation of "elastic twins." (3) Formation of stable twin layers. (4) Thickening of the twin layers. A new method is described for the investigation of the pressure figure by optical interference, which makes it possible to observe distortions of the crystal surface during the formation of "elastic twins." It is shown that the character of load distribution on t contact surface is of paramount importance. It demonstrated that increase or decrease in length or thic ness of the "elastic twins" are determined by conditio on their boundary surfaces. The formation of pol synthetic twins is explained. Methods are given f regulating the thickness of layers.

548.54 23

Crystal habit and internal structure. III. WELLS, A. *Phil. Mag.*, **37**, 605–30 (*Sept.*, 1946).—A continuation previous papers [Abstr. 694 (1947)]. Wulff's theorem applied to the problem of the effect of environment crystal habit, and the conditions for measurements of t relative rates of growth normal to crystal faces to yie ratios of surface free energies. The significance complex forms of crystal faces is discussed, and the effec of impurities and partial dissolution during growth, the development of the crystal face is studied. It suggested that the equilibrium shape of a crystal probably a simple development. L. S.

548.7 23

Errata: Lattice energies, equilibrium distances, con pressibilities, and characteristic frequencies of alkali hali crystals. HUGGINS, M. L. *J. Chem. Phys.*, **15**, 2 (*April*, 1947).—See Abstr. 997 (1937).

548.7 : 539.4 *see Abstr.* 2274

548.7 : 539.62 *see Abstr.* 2282

548.73 : 532.782 23

X-ray reflexions from dilute solid solutions. HUAN K. *Proc. Roy. Soc. A*, **190**, 102–17 (*June* 17, 1947).—T effect on X-ray reflexion of deviations of the atoms fro the ideal lattice sites caused by the presence of random distributed foreign atoms in a dilute solid solution investigated quantitatively. One is led to two types effects, exactly analogous to the thermal effects: (i) weakening of the ordinary interference maxima; (ii) t presence of "diffuse maxima" associated with t ordinary maxima. It should be possible to detect experimentally, but the effect (ii) mixes with the therm diffuse maxima and is found to be very much smaller ordinary temperatures. This conclusion is, however, n regarded as general, especially in view of the anisotrop nature of the thermal effect.

73 : 537.583 : 621.385.13.032.216 2323
entification by X-rays of interface compounds on
ide" cathodes. ROOKSBY, H. P. *Nature, Lond.*, **159**, 10 (*May* 3, 1947).—[Abstr. 2039 B (1947)].

73 : 541.23 *see Abstr.* 2296

735.44 2324
machine for the application of sand in making Fourier ections of crystal structures. MCLACHLAN, D., JR., CHAMPAYGNE, E. F. *J. Appl. Phys.*, **17**, 1006–14 ., 1946).—The machine is described and results trated by projections of known structures. The nematical principle is identical to that of Bragg, but sand instead of photographic film as the medium for lucing contrasts in electronic density throughout the ection. A 2-dimensional Fourier projection com- ng the addition of 150 terms may be made in about ours by a single worker. The subdivisions of the ection face are sufficiently fine to assure an accuracy reat as the X-ray data from Cu radiation will warrant. A.

735.44 2325
semi-polar form of Fourier series and its use in crystal cture analysis. LUKESH, J. S. *J. Appl. Phys.*, **18**, 6 (*March*, 1947).—The procedure is designed to nit simple and fairly rapid computation and recording ne density contributions of all planes at all points in unit cell. Its particular advantage is in the case of rosymmetrical projections where phases must be gned experimentally. Adjustment of phases involves re-addition of numbers rather than a complete new mation. The method also requires a minimum of pment which is easily constructed at negligible ense. A.

736.182 : 549.212 2326
tructure of graphite. NELSON, J. B., AND RILEY, P.; ROOKSBY, H. P., AND STEWARD, E. G. *Nature*, d., **159**, 637–9 (*May* 10, 1947).—The occurrence of son's "extra" lines [Abstr. 474 (1947)] could not be firmed, and it is suggested that they are due to a not e monochromatic X-ray beam.

736.37 = 5 2327
rystal structure of bayerite. MONTORO, V. *Ric. Sci.*, 565–71 (*Oct.*, 1942) *In Italian.*—X-ray examination of mple of $Al_2O_3 . 3{\cdot}14\ H_2O$, from an aged Al cathode n X-ray tube, showed a stratified structure of regular agons with the parameters $a = 5{\cdot}01$ Å, $c = 4{\cdot}76$ Å containing 2 mol. $Al(OH)_3$. Density = 2·49, mol. = 62·7. J. A. W.

736.42 : 541.57 2328
he crystal structure of hydrazinium dichloride, $N_2H_6Cl_2$. NOHUE, J., AND LIPSCOMB, W. N. *J. Chem. Phys.*, **15**, -19 (*March*, 1947).—Accurate values have been rmined by X-ray diffraction. The N—N separation ·42 Å, equal to that in hydrazinium difluoride and 5 Å shorter than in gaseous hydrazine. Each chloride forms hydrogen bonds with three N atoms, the cture consisting of a 3-dimensional network of -H . . . Cl bonds. The angle N—N—H . . . Cl is °. The configuration of the $N_2H_6^{++}$ ions is *trans*. A.

736.442 ≃ 3 2329
he crystal structure of $K(CdCl_3)$. BRANDENBERGER, *Experientia*, 3 (*No.* 4) 149 (1947) *In German.*—The cture is of $E2_4$ type. The lattice constants *a* and *b* w a contraction of ~2% compared with the isotype $l_4(CdCl_3)$, but *c* is about the same. A.

736.452 2330
Crystal structure of $Co[Hg(CNS)_4]$. JEFFERY, J. W. *ture, Lond.*, **159**, 610 (*May* 3, 1947).—The crystal class is $\bar{4}(S_4)$ and space group $I\bar{4}(S_4^2)$, $a = 11{\cdot}09$ Å, $c = 4{\cdot}37$ Å. There are 2 molecules per unit cell. Co-ordinates of Co and S (relative to Hg) are:—Co: ½, 0, ¼ or ½, 0, ¾; S: 0·15, 0·13, 0·28. This gives an Hg—S distance of 2·5 Å.

548.736.453.2 2331
Physical properties and cation arrangement of oxides with spinel structures. I. Cation arrangement in spinels. VERWEY, E. J. W., AND HEILMANN, E. L. *J. Chem. Phys.*, **15**, 174–80 (*April*, 1947).—By means of a detailed X-ray study of a large number of oxides having a spinel structure, it has been established whether they crystallize in the "normal" spinel-type structure, XY_2O_4, or in the "inversed" type of structure, $Y(XY)O_4$, discovered by Barth and Posnjak. Certain rules can be derived which are also applicable to more complicated spinels or to solid solutions of different spinel oxides. Madelung constants have been calculated for different spinel types in order to investigate their stability on the basis of an ionic concept of the chemical bond (Born's lattice theory). The experimental results are only partially explicable on this basis. All exceptions to the electrostatic principles can be understood by assuming that Fe^{3+}, Ga^{3+}, In^{3+}, Zn^{2+}, and Cd^{2+} favour a configuration having the co-ordination number 4, because of a considerable covalent contribution to the chemical bond for that configuration. A.

548.736.453.2 : 537.311.32 2332
Physical properties and cation arrangement of oxides with spinel structures. II. Electronic conductivity. VERWEY, E. J., HAAYMAN, P. W., AND ROMEIJN, F. C. *J. Chem. Phys.*, **15**, 181–7 (*April*, 1947).—The relations between the electronic conductivity of certain spinels and the arrangement of the cations in the crystal structure (see preceding Abstr.) are studied. Several arguments favour the assumption that Fe_3O_4 contains both divalent and trivalent Fe in the 16-fold position. The transition point in the neighbourhood of liquid-air temp. is probably associated with an increased degree of order at low temp. in the distribution of the 8 electrons between the 16 Fe-lattice points per unit cell. The considerably increased conductivity below the transition points shows tetragonal anisotropy when the crystal is cooled in a magnetic field. The possible distributions of the electrons in the crystal at low temp. are discussed. A.

548.737 2333
The crystal structure of sucrose sodium bromide dihydrate. BEEVERS, C. A., AND COCHRAN, W. *Proc. Roy. Soc. A*, **190** 257–72 (July 8, 1947).—The complete crystal structure of sucrose sodium bromide dihydrate has been determined. The crystals are orthorhombic, with space-group $P2_12_12_1$, and cell-edges $a = 21{\cdot}92$, $b = 9{\cdot}72$, $c = 8{\cdot}43$ Å. The Br positions were obtained from Patterson–Harker syntheses, and the signs of the *F*'s of the (0*kl*), (*h*0*l*) and (*hk*0) planes from the change of intensity from the Cl to Br compounds. Fourier projections parallel to the three axes were used to determine the complete structure. Direct proof that sucrose may be described as α-*d*-glucopyranosido-β-*d*-fructofuranoside has been obtained for the first time. A.

548.737 : 544.64 2334
X-ray investigation of d-α-Br, Cl and CN camphor. WIEBENGA, E. H., AND KROM, C. J. *Rec. Trav. Chim. Pays-Bas*, **65**, 663–81 (*Oct.–Nov.*, 1946).—The substances are isomorphous, space group $P2_1$. The signs of the *h*0*l* structure amplitudes were determined by the changes in intensity in going from one halogen substituent to another. The *x* and *z* co-ordinates were then found by

Fourier synthesis. The y co-ordinates were obtained roughly from a model and refined by comparison of observed and calculated $0kl$ and $hk0$ intensities for the CN compound. The halogens are *trans* to the $C(CH_3)_2$ bridge. A. J. C. W.

MINERALOGY 549

549.211 : 535.323 : 535.551 *see Abstr.* 2120

549.211 : 548.0 : 535.43 *see Abstr.* 2119

549.212 : 548.736.182 *see Abstr.* 2326

GEOPHYSICS 55

550.372 : 621.396.11 2335

A new method for the determination of the electric constants of the earth's surface. NIESSEN, K. F. *Philips Res. Rep.*, **1**, 465–75 (*Dec.*, 1946).—[Abstr. 2063 B (1947)].

550.837.6 : 621.318.4 = 5 2336

Resistance coupling of induction coils in electric subsoil prospecting. BELLUIGI, A. *Ric. Sci.*, **13**, 770–2 (*Dec.*, 1942) *In Italian.*—[Abstr. 1994 B (1947)].

551.2 : 621.396.99 2337

Use of the broadcast band in geologic mapping. KERWIN, L. *J. Appl. Phys.*, **18**, 407–13 (*April*, 1947).—[Abstr. 2109 B (1947)].

METEOROLOGY 551.5

551.508.71 : 533.275 *see Abstr.* 2058–9

551.510.535 2338

Atmospheric tides in the ionosphere. II. Lunar tidal variations in the *F* region near the magnetic equator. MARTYN, D. F. *Proc. Roy. Soc. A*, **190**, 273–88 (July 8, 1947).—For I, see Abstr. 1072 (1947). Three years' data for the heights and critical frequencies of the F_1 and F_2 regions at Huancayo, Peru, are examined for lunar tides. Semi-diurnal lunar tides are found in all quantities save $f^0_{F_1}$. It is found that the lunar variation in the F_2 region depends on solar time in both phase and amplitude. At certain solar epochs it attains very large amplitudes, up to 60 km in $h^{max}_{F_2}$ and 28% in $f^0_{F_2}$. The theory of these variations is further developed. A.

551.510.535 : 621.396.11 2339

Note on the sporadic *E*-layer. FERRELL, O. P. *Proc. Inst. Radio Engrs, N.Y. Wav. Electrons*, **35**, 493–4 (*May*, 1947).—A discussion of the formation of the E_s cloud.

551.510.535 : 621.396.9 : 523.53 *see Abstr.* 2006

551.513.1 2340

A discussion of the pressure-tendencies associated with gradient and horizontal geostrophic flow. A formula for the variation with height of the vertical velocity. MATTHEWMAN, A. G. *Phil. Mag.*, **37**, 706–16 (*Oct.*, 1946).—Horizontal flow with an appreciable north or south component implies a pressure tendency $\geqslant$ normally observed; the excess may be reduced or extinguished by certain methods, and these are described. Gradient flow implies terms in the formula for the divergence $\geqslant$ the term involving the pressure tendency, and such flow through a horizontal neighbourhood of unsaturated air implies a gradient of vertical velocity; a formula is obtained for this. L. S. G.

551.513.1 2341

Vertical transport of heat by turbulence in the atmosphere. PRIESTLEY, C. H. B., AND SWINBANK, W. C. *Proc. Roy. Soc. A*, **189**, 543–61 (*June* 3, 1947).

551.515.4 : 621.396.91 2342

The location of thunderstorms by radio direction-finding. ADCOCK, F., AND CLARKE, C. *J. Instn Elect. Engrs, Pt III*, **94**, 118–25 (*March*, 1947).—[Abstr. 1843 B (1947)].

551.521.2 : 523.32 : 551.524.7 *see Abstr.* 2347

551.521.3 234

Brightness and polarization of the daylight sky a various altitudes above sea level. TOUSEY, R., AN HULBURT, E. O. *J. Opt. Soc. Amer.*, **37**, 78–92 (*Feb* 1947).

551.524.7 234

Temperature of the upper atmosphere. SEATON, S. I *Phys. Rev.*, **71**, 557 (*April* 15, 1947).—Assuming the ioni recombination coefficient in the upper atmosphere to b proportional to the cube of the absolute temp., T, curve are given showing the variation of T between heights c 100 and 300 Km at various latitudes. W. E. I

551.524.7 234

Ozonosphere temperatures under radiation equilibrium GOWAN, E. H. *Proc. Roy. Soc. A*, **190**, 219–26 (July 8 1947).—A revised calculation [see Abstr. 58 (1931) 5479 (1936)] is given, making use of new data. Th absorption of solar radiation will cause high temp around 35–50 km, even though the ozone max. is a 22 km. The calculated temps. are 15–20°K higher tha the Omaha balloon observations, but the slope in th lower stratosphere is in agreement.

551.524.7 234

Night cooling of the ozonosphere. GOWAN, E. H *Proc. Roy. Soc. A*, **190**, 227–31 (July 8, 1947).—Som estimate of the cooling of the ozonosphere can b made using the calculated solar energy absorbed i various layers. After sunset this source of energy removed and cooling occurs mainly by radiation up an down. The conclusion is reached that during a nigh the cooling is ~30°C at 50 km and only a fraction of degree below 25 km. This means that the ozonosphe temperature inversion around 40 km will persist throug out the night.

551.524.7 : 551.521.2 : 523.32 234

Atmospheric temperature from infra-red emissio spectra of the moon and earth. I. The ozone laye ADEL, A. *Phys. Rev.*, **71**, 564 (*April* 15, 1947).

551.571.4 234

Turbulence and diffusion in the lower atmosphere wi particular reference to the lateral effect. DAVIES, D. I *Proc. Roy. Soc. A*, **190**, 222–44 (July 8, 1947).—It suggested that one of the reasons for the discrepanci of Sutton's theory with experiment [see Abstr. 25 (1943)] is the neglect of the lateral component of tu bulence, and the present paper attempts a quantitati estimate of its effect. The value for evaporation is n appreciably affected, but concentration, and its rate decay, turn out much nearer the experimental value.

551.576.4.08 23

An azimuthal method of measuring cloud height with searchlight. BILHAM, E. G. *Nature, Lond.*, **159**, 677 (*May* 17, 1947).—Measurement, from a distant point, the elevation of the patch of cloud illuminated by vertically-directed searchlight, is inaccurate for clou heights > a few thousand ft. If the searchlight is tilte at an appropriate angle, measurement of azimuth angl gives greater accuracy.

578.1 : 536.423.1 2350

he fall of rain. RICHARDSON, E. G. *Proc. Univ. ham Phil. Soc.*, 394–7 (*Nov.*, 1946).—The theory of fall of single raindrops under the combined effects of ity and evaporation is discussed, and relationships veen size of drop and height above ground level ved. Experiments on the free falling of drops and r loss of mass *en route* are described and the results nined in the light of the theory. The possibility of g such measurements to deduce rates of evaporation so considered. A.

594.221 : 537.523.4 : 621.396.821 2351

he nature and variation of atmospherics caused by ning discharges. NORINDER, H., AND STOFFREGEN, *Ark. Mat. Astr. Fys.*, **33 A** (*No.* 3) *Paper* 16, 44 *pp.* 7).—The deviations which appear in simultaneous . records of field changes produced by lightning es in an open aerial and in the output of a radio ver tuned to different frequencies are discussed. The complex nature of atmospherics, both with respect to frequency and amplitude, is shown to require involved recording equipment for its investigation. Four methods of recording with c.r.o. are adopted and these permit time resolutions varying from several seconds to a few μseconds. Two field stations, one of which is portable, are described. Typical oscillograms exemplifying the great variety of wave shapes of atmospherics are reproduced. Five principal types are discussed, occurring in the following time sequence: oscillations preceding the lightning stroke proper by about one second, ordinary precursors, main oscillatory wave train, wave tail, and subsequent oscillations, the first and last types being of much smaller amplitude than the rest. Reflection phenomena from the ionosphere are considered. Preparations have been made to continue the investigations by simultaneous recording at 2 or 3 stations. R. H. G.

551.594.5 : 537.525 *see Abstr.* 2159

BIOLOGY 57/59

088.2 : 621.396.615 : 534.321.9 *see Abstr.* 2080

.2 : 537.591.15 2352

osmic radiation and cancer. FIGGE, F. H. J. *Science*, , 323–5 (*March* 28, 1947).—Mice inoculated with hylcholanthrene acquired tumours in an average time 1·3 weeks. Mice similarly treated, but having 6 or m of Pb placed on top of their cages, acquired ours in the significantly shorter average time of weeks. The difference is attributed to the intensity atural ionizing radiation being increased under the plates by cosmic ray shower production. The role ibuted to the methylcholanthrene is that of sensitizing tissues to cosmic radiation. D. E. L.

DICAL SCIENCE . HUMAN PHYSIOLOGY 61

84 2353

ffect of a constant current on vision. KRAVKOV, S. V., GALOCHKINA, L. P. *J. Opt. Soc. Amer.*, **37**, 181–6 *rch*, 1947).—Experiments described in this paper nonstrate that a weak electrical current running ough the eyeball may noticeably alter the sensitivity od and cone vision. The direction of these changes ends upon which pole is placed on the eyeball. The hors advance an hypothesis explaining the action by nges in the relative concentration of Ca and K ions the neighbourhood of poles. Special experiments formed with Ca and K iontophoresis have confirmed interpretation. A.

.84 : 535.43 2354

laboratory study of visibility through clouds. LANG-TH, G. O., JOHNS, M. W., WOLFSON, J. L., AND HO, H. F. *Canad. J. Res. A*, **25**, 49–57 (*Jan.*, 1947).—elation is proposed between the visibility of an object its brightness, the brightness and density of the cloud the contrast of the object with the background. eriments performed with an NH_4Cl smoke cloud in hamber 1·8 m long, at brightness 1–100 mlamberts icate that the relation is fulfilled adequately. A.

.84 : 535.43 2355

he recognition of objects nearly obscured by a cloud. NGSTROTH, G. O., JOHNS, M. W., WOLFSON, J. L., AND HO, H. F. *Canad. J. Res. A*, **25**, 58–61 (*Jan.*, 1947).— optical density of smoke required to produce loss of nition of a square test object was found to be linearly ted to the logarithm of the ratio of object to cloud htness, and was from 12 to 23% < that associated with total obscuration, the magnitude of the difference depending on brightness conditions. A.

612.843.6 : 771.534.544 *see Abstr.* 2365

612.85 = 5 2356

The mechanism of the effect of movements of the head on the location of sounds. GEMELLI, A. *Ric. Sci.*, **13**, 5–10 (*Jan.*, 1942) *In Italian.*—A series of experiments with a subject in various positions, stationary or moving (seated in a slowly rotating chair), with the head fixed or free to move, and with various kinds of sounds, leads to the conclusion that sound-source location is a complex process, and that neither time-, intensity- nor phase-difference between stimuli reaching the two ears is alone sufficient to account for the phenomenon. J. A. W.

612.852 2357

Short duration auditory fatigue as a method of classifying hearing impairment. GARDNER, M. B. *J. Acoust. Soc. Amer.*, **19**, 178–90 (*Jan.*, 1947).

614.71 : 544.4 : 621.317.39 2358

Electrical detection of traces of poisonous gases in the atmosphere. BOEKE, J. *Philips Tech. Rev.*, **8**, 341–5 (*Nov.*, 1946).—Finely divided Pt which catalyses an oxidation reaction is found to be hindered in its function by many gases which are also poisonous to the human body. Based on this fact, an instrument has been designed for detecting poisonous gases, e.g. CO and HCN. A Pt catalyst on a Pt wire serves as one of the resistance branches in a Wheatstone bridge and a mixture of CH_3OH and air is conducted along it. The heat developed by the oxidation of the alcohol keeps the Pt wire at 120–150°c. When the catalyst is poisoned the oxidation reaction ceases, the wire cools off and the bridge is unbalanced. A simple portable model is described. A.

614.898 : 621.386.86 2359

Absorption measurements for broad beams and 1 and 2 megavolt Roentgen rays. SINGER, G., BRAESTRUP, C. B., AND WYCKOFF, H. O. *Amer. J. Roentgenol. Radium Ther.*, **56**, 771–5 (*Dec.*, 1946).—With penetrating radiation excited at megavolt values, true absorption becomes less and the scattered component more important, particularly since broader beams are utilized. The paper reports protective data obtained from measurements made on a 42-in concrete wall, details of procedure being given. The variation of dosage rate with the distance of the operator from the wall is shown graphically. In

practice the emission from a 1 MV installation at 1 m for 1 mA tube current is as high as 20 r/min. B. J. L.

615.849 2360

Quality of radiation in Roentgen therapy. NEWELL, R. R. *Radiology*, **48**, 215–31 (*March*, 1947).—Reviews the various attempts to define the quality of X-rays from early days. In very high voltage irradiation a new factor has to be taken into consideration, since a large proportion of the total radiation passes completely through the patient's body, and overlapping of these "exit doses" can have a destructive effect on sound tissues also necessarily irradiated. Throughout the paper, which includes a bibliography, the greater accuracy of physical measurement of radiation, compared to results obtained clinically, is stressed. B. J. L.

616–073.75 : 621.386.1 2361

Oil circulation in diagnostic Roentgen tubes. MORGAN, R. H., AND VAN ALLEN, W. W. *Amer. J. Roentgen Radium Ther.*, **57**, 362–7 (*March*, 1947).—[Abstr. 2046 (1947)].

616–073.755 : 621.386.8 : 778.33 : 620.179.152 23

X-ray fluoroscopy with enlarged image. BURGE G. C. E., COMBEE, B., AND VAN DER TUUK, J. H. *Phili Tech. Rev.*, **8**, 321–9 (*Nov.*, 1946).—[Abstr. 1645 (1947)].

GLASS . CERAMICS 666

666.246.3 : 535.343.2–15 *see Abstr.* 1819

METALLURGY 669

669 : 541.57 : 539.11 *see Abstr.* 1917

669.715.74.5 : 541.123.3 *see Abstr.* 2285

PHOTOGRAPHY 77

77.08 2363

A new one-step photographic process. LAND, E. H. *J. Opt. Soc. Amer.*, **37**, 61–77 (*Feb.*, 1947).—The camera, conventional in shape, contains a strip of sensitive paper in addition to the negative material, and the two strips are pulled out of the camera in contact through pressure rollers which deposit a film of viscous reagent between them. This reagent develops the negative image, forms a Ag complex with the unexposed grains, transfers this to the positive sheet, and stabilizes it there. This process takes ~1 min at temps. between 30 and 100°F. The paper discusses several such development processes, and the factors operative at various stages. Various characteristic curves are given, and the photographic usefulness of the process interpreted. A.

771.36 : 621.317.39 2364

Cathode-ray tube shutter-testing instrument. DIGHTON, D. T. R., AND ROSS, H. MCG. *J. Sci. Instrum.*, **24**, 128–33 (*May*, 1947).—[Abstr. 1970 B (1947)].

771.534.544 : 612.843.6 2365

Photographic granularity and graininess. III. Some characteristics of the visual system of importance in the evaluation of graininess and granularity. JONES, L. A., AND HIGGINS, G. C. *J. Opt. Soc. Amer.*, **37**, 217–63 (*April*, 1947).—[See Abstr. 2426 (1946)]. From past and present work it is concluded that the neural responses from relatively few cones around the centre of the fovea determine the perception of graininess. When a granular field is viewed, these cones are stimulated by rapidly varying illumination on account of physiological nystagmus. Computations from experiments with graininess patterns show that the sensitivity of a retinal receptor to the time rate of change of incident illumination is inversely $\propto$ average illumination. Granularity depends on the structure of the silver deposit and is best evaluated in terms of the frequency of occurrence of the density differences, called "syzygetic," existing between adjacent elements of the surface. These elements should be about equal in size to the optical projection by the eye of the central foveal cones on to the sample, if this is at a distance where graininess is just perceptible. Instrumental technique is discussed, also the problem of a uniform graininess scale. S. T. H.

771.534.562 2366

A note on the intermittency effect. WEIL, R. *Proc. Phys. Soc., Lond.*, **59**, 161–8 (*March*, 1947).—The nature of the effect is described and a new criterion for its detection mentioned. This is applied to the manifestation of the effect when an a.c. light source is used. The experimental arrangement employed in the investigatio is given, and the results briefly discussed.

778.33 : 535.37 23

The X-ray storage properties of the infra-red stora phosphor and application to radiography. BERG, O. AND KAISER, H. F. *J. Appl. Phys.*, **18**, 343–7 (*Apr* 1947).—The ability of infra-red phosphors to store X-r energy for periods of time and release it on radiati with infra-red can be utilized in the temporary permanent recording of the latent X-ray image. Harmf X-radiation can thereby be eliminated. A form "flash fluoroscopy" is suggested. Graphs show t behaviour of the phosphors under X-radiation a comparative radiograms and phosphorograms are give

778.33 : 620.179.152 23

The utility of radium in complex radiographic studie WISE, D. H. *Industr. Radiogr. Non-Destr. Test.*, **5**, 23 (*Fall No.*, 1946).—[Abstr. 1646 B (1947)].

778.33 : 620.179.152 : 621.386.8 : 616–073.755 *see Abstr.* 2362

778.33 : 778.37 = 82 *see Abstr.* 2369

778.37 : 531.766 = 82 *see Abstr.* 1741

778.37 : 778.33 = 82 23

Methods of synchronization for very brief X-r exposures. STRAKHOVSKII, G. M., AND TSUKERMAN, V. *Bull. Acad. Sci. URSS, Dep. Sci. Tech.* (*No.* 3) 371– (1946) *In Russian.*—Various methods are discussed whi permit X-ray photography of μsec processes, such passage of a bullet through a target, and the explosi of lead azide. D.

778.64 23

Optimum spectral sensitivities for a reversible co film process. BINGHAM, R. H., AND HOERLIN, H. *J. O Soc. Amer.*, **37**, 199–210 (*March*, 1947).—A method w developed for theoretical evaluation of spectral sensitiv functions to be used with a specified set of subtracti primary dyes in a reversible colour process. Hyp thetical blue, green, and red sensitivities were varied i systematic way to obtain the curves which minimize t errors of colour reproduction; these were found to non-overlapping and to have maxima at 450, 540, a 630 mμ, respectively. Colour renditions are calcula for two sets of sensitivity functions alike in the blue a green, but different in the red, and conclusions are dra regarding changes of the curves of experimental se tizers, which would yield specific improvements reproduction.